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COMPUTE!

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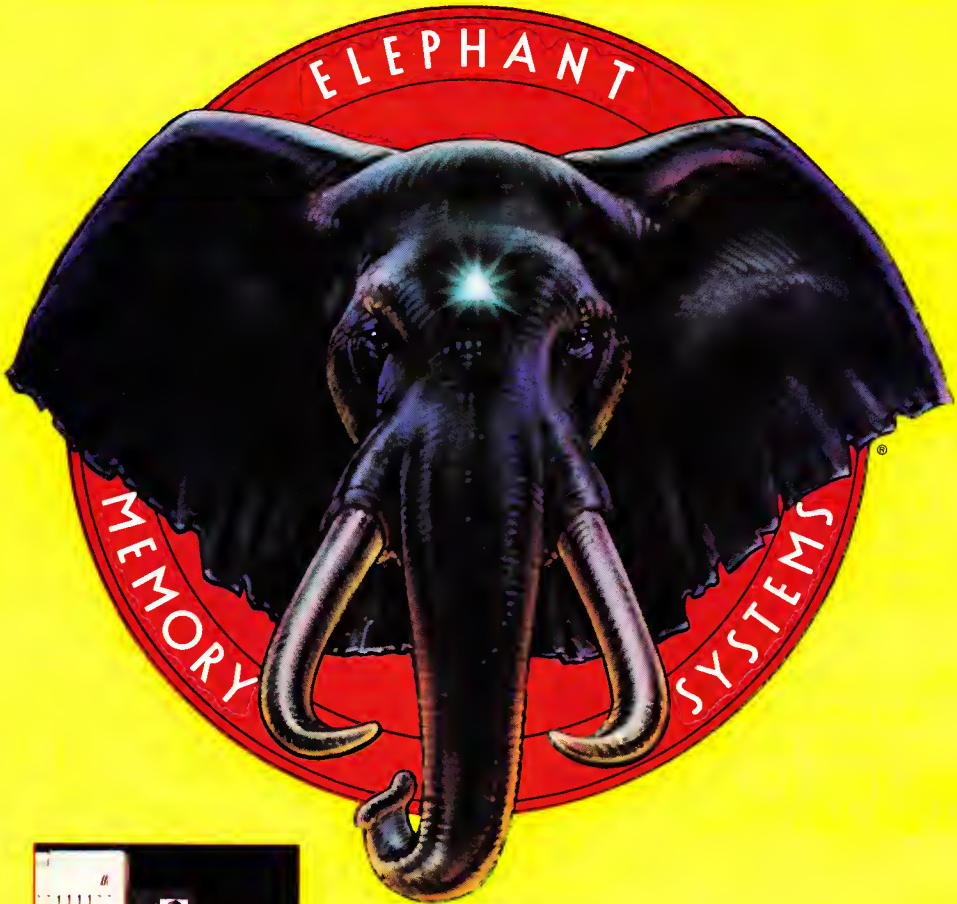

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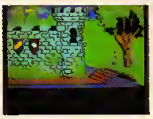

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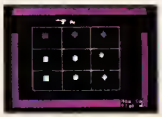

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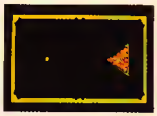

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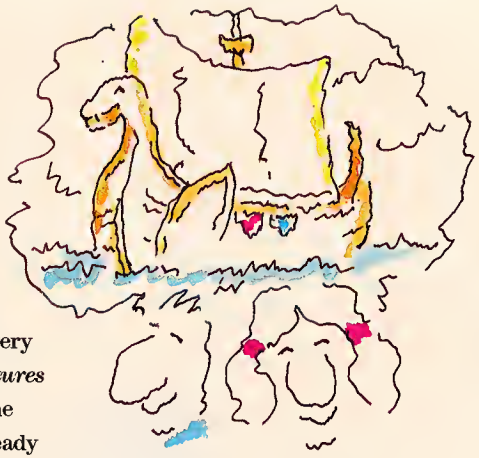

Christmas Day was approaching in the Nice household. But Mr. and Mrs. Nice (Bill and Janet) didn't know what to get for their Nice children, Tom and Marybeth. They thought and thought, but nothing seemed to hit them just right. "Hula hoops?" said Bill. "No," said Janet. ● Tom and Marybeth, on the other hand, knew exactly what they wanted. In fact, they dreamed of it almost every night: *DawnTreader*, the latest in the *Adventures In Narnia* computer game series based on the stories by C.S. Lewis. Tom and Marybeth already had the first game, *Narnia*, but now they dreamed about how they would captain the good ship Dawn Treader through the ocean to World's End. They dreamed about finding dufflepuds and sea serpents. And they knew that, just like *Narnia*, *DawnTreader* would be exciting, action-packed, and even educational, teaching them sound principles their Mom and Dad agreed with, too. But they wondered: would *DawnTreader* be under the tree come Christmas Morn? ● One day very close to Christmas, Bill and Janet Nice reached into the cupboard for *Narnia* (after all, it's a game *every*one in the family can enjoy) and came across a note. It said, "We're dreaming of *DawnTreader*. Love, Tom and Marybeth."

● Finally, Bill and Janet had their answer. "It's perfect!" exclaimed Bill. "Let's get them the next Narnian adventure, *DawnTreader!*" "Oh Bill," sighed Janet, "What a nice idea!" ● It was. Wouldn't it be nice for your children, too?

Merry Christmas from the Nice household to yours!

DawnTreader is available at all Waldenbooks stores and computer specialty stores. All *Adventures In Narnia* games are compatible with Apple II series® and Commodore 64™ home computers.

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AP Apple, **AT** Atari, **P** Pet/CBM, **V** VIC-20, **C** Radio Shack Color Computer, **64** Commodore 64, **Mac** Macintosh, **TI** Texas Instruments, **PCjr** IBM PCjr, **PC** IBM PC. *All or several of the above.

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EDITOR'S NOTES

Never in the five-year-plus history of COMPUTE! have I written an editorial that could be interpreted to be as self-laudatory as this one. My apologies in advance. I assure you the topic is worthwhile. In early 1980, a fellow named Michael Tomczyk approached me with a desire to get involved in this budding industry of ours. He wanted to begin learning the ropes and building contacts in the rapidly expanding personal computer market. I gave him some sample assignments which he carried out well, and we began a relationship that has lasted through the years.

For a variety of reasons, the above being the foremost, I was aware that "someday" Michael wanted to write a book on Commodore and Jack Tramiel. He was aware (given our history of expertise in Commodore-relevant areas) of our interest in publishing such a book. When Michael left Commodore this past summer, he began work in earnest on his long-dreamed-of book. And we began work in earnest on agreeing on a contract. Both were finished at almost the same time, and we put a task force of senior editorial staff, notably Richard Mansfield and Juanita Lewis, immediately to work on it.

The result is a just-released COMPUTE! book, *The Home Computer Wars*. It's an exciting, enticing chronology of Commodore, the home/personal computer industry, and the impact of Jack Tramiel. As a first-hand observer of the time frame covered by the book, I can attest to its interest. It's also a well-written, well-edited book. I'll apologize again for such a syrupy editorial, but the book merits my comments. It is, after all, our first book division release in hardback, and our first non-applications book. We are quite pleased with it.

There seems to be some concern regarding the present state of the industry with all of the vendor and manufacturer consolidation that's presently occurring. Is the home/personal computer revolution over? Has the fad flagged? I think not. We argued some months ago that within any revolution there are companies that lead, companies that follow, companies that by age and evolution are "mature" growth companies, and companies that by different definition are "entrepreneurial" growth companies. It would seem to make sense that we've arrived at an evolutionary stage in our industry's development that's almost a pause to catch our collective breath. We're between buses. The dust is still settling from a rather massive industry shakeout that's been five years in the making; things have at last slowed down for a matter of months, and industry watchers are saying, "Ah-ha . . . that's it, I told you so . . . a fad."

Perhaps, instead, a better perspective would be that we're pausing between surges, and we fully expect this industry to again move rapidly ahead in the not too distant future. It might be sparked by a major coup on the part of a single manufacturer; it might be sparked by a single piece of software, but the march will resume. Commodore's Amiga Lorraine is just around the corner, and many argue that it represents the same quantum leap in personal computing technology and features that the VIC-20 did only three years ago when the notion of a $299 color and sound computer was hard to believe, never mind one selling for $200 or even $100. And not long before that, customers bought Apples because they wanted something, *anything*, that would run a revolutionary new program called *VisiCalc*.

So, we're confident we're not a fad, not a blip on a relatively minor time line in some future historian's textbook. Personal computing is here to stay, and we're sure of it. Until next time, enjoy your COMPUTE!.

Editor In Chief

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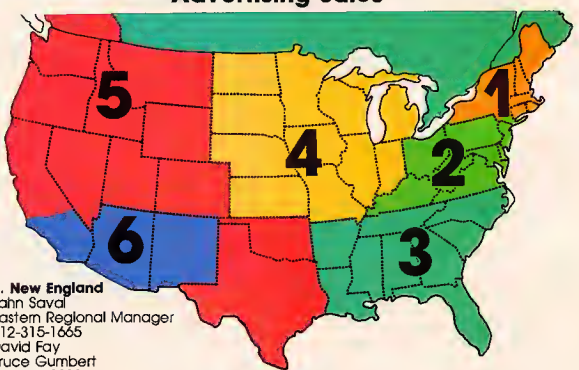

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I have a Gemini 10X printer with a cloth ribbon, and have discovered a way to refresh the ink on a used cloth ribbon. First take the ribbon out of the printer and spread it out on newspaper, then spray an even but light coat of WD-40 on the ribbon. This will darken the ribbon a bit. After letting the ribbon dry overnight, wind it back into the cartridge and reinstall it in the printer. It's almost as good as a brand-new ribbon. This works because the WD-40 breaks up the ink particles and redistributes them from the unused portions of the ribbon.

John A. Hashem

Your method seems to be a good one, since WD-40 is a solvent, in addition to being a lubricant. The only question is whether or not the remaining WD-40 would interfere with the printhead, or infuse your correspondence with a petroleum odor. The added lubrication couldn't hurt, but it could cause extra dust to accumulate and gum up the printhead. Here's another trick that's worked for us. Pull out a small section of the ribbon, and make a half-twist. Now wind the twist into the cartridge and continue winding until the twist pops out again (it could take a while). The ribbon is now upside-down, and the rear surface of the ribbon has now come to the front. Since printers use only a portion of the ribbon, this should bring a fresh, unused part of the ribbon into play. Do not use this technique with carbon ribbons (which work only in one direction), or if your ribbon cartridge is too tightly wound to let the twist pass all the way through. Some ribbon cartridges automatically perform this half-twist for you.

IBM PC/PCjr BASIC Compatibility

I would like to know if a program written for the PCjr in Cartridge BASIC would work on the PC with a color/graphics adapter and BASIC?

Richard Bookal

The PC and PCjr are quite compatible, considering the differences in the hardware. Since Cartridge BASIC contains all the commands of BASICA (plus a few PCjr-specific commands), most programs written in BASIC or BASICA on the PC will work on the PCjr. To go the other way, the PC must have BASICA and the color/graphics adapter, and it helps to have the game controller adapter (and joystick), since many PCjr programs take advantage of the built-in joystick interface.

One problem when running a PCjr program on the PC is that the PCjr has several graphics modes not found on the PC. The PC with the color graphics adapter supports SCREEN 1, the 320 × 200 four-color mode; and SCREEN 2, the 640 × 200 two-color mode. The PCjr, of course, supports quite a few more modes, including a 160 × 200 and 320 × 200 16-color mode. It's possible (though by no means easy) to rewrite such a PCjr program to run on the PC. Remember that some of the commands in Cartridge BASIC are not found in PC BASICA. These include PCOPY, PALETTE, and PALETTE USING.

Additionally, the PCjr boasts a 3-voice, 10-bit sound chip with white noise capability. The PC has only a programmable beeper, but since the PCjr also has this capability, you can use the beeper instead if you're interested in compatibility.

As long as you avoid these enhanced PCjr features, you can write programs on the PCjr that will run as is on the PC. Since both machines use the same microprocessor, machine language programs will also transfer, as long as you avoid direct calls into the ROMs. Instead, make use of the BIOS routines, documented in the PC or PCjr Technical Reference Manual. *Also, do not use software timing loops, since the PC generally runs faster than a PCjr. You can instead use the programmable timer that behaves the same on both machines. IBM programmers have been eagerly awaiting a new color/graphics card for the PC that will emulate some of the features of the PCjr, but to date no such card exists.*

Commodore Comma Conflicts

I have a Commodore 64. Whenever I try to INPUT something into a string using a comma, the computer rejects everything thereafter, including the comma. How do you enter commas in response to an INPUT statement?

Ronald Weber

INPUT is a versatile command, but you've run smack into its biggest limitation. You may not be

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aware of the intended purpose of the comma. For example, try this program:

```
10 INPUT "Name: Last, First";L$,F$
20 PRINT "Your name is ";F$;" ";L$
```

When you run this, you can enter both your last and first name on the same line in response to the INPUT statement. You separate the items with commas. Alternately, you can press RETURN after the first entry, and a question mark appears for the next. It's sometimes very convenient to use the comma for this purpose. But if the INPUT statement does not require more than one entry, the comma makes no sense to the computer, and it reminds you that it didn't know what to do by displaying ?EXTRA IGNORED. Everything thereafter (including the comma) is seen as an errant second input and is therefore thrown out. You may have also noticed that colons behave much like commas, giving you ?EXTRA IGNORED.

Aside from programming your own special version of INPUT by using the GET command, there is one trick that lets you enter anything into an INPUT statement, even leading and trailing spaces (which are normally removed). Just start your entry with a quote. This will put you in quote mode, so be careful with cursor controls. Alternately, you could enter two quotes, then backspace with DELete to erase the second quote. This gives you the leading quote, but keeps you out of quote mode. INPUT accepts everything within quotes. Notice, though, that the quote marks are not included as part of the entry. Only what's inside the quotes will count. Also keep in mind that these limitations (or features) also apply to INPUT# with tape, disk, or other devices.

Sometimes the best solution is to just write your own version of the INPUT statement. Try this small subroutine with GOSUB 10000. It does not allow cursor controls (other than backspacing with DELete), but it will accept any printable character. The line typed as input is available in the variable IN$. No prompt is printed, so your main program should PRINT the question before calling this subroutine. Since a string is limited to 255 characters, the variable IL is set to 255 on line 10000. If you want a smaller limit, change line 10000, or just set IL in your main program, make IN$="", and GOSUB 10010.

```
10000 IN$="":IL=255                    :rem 213
10010 PRINT "{+3}{LEFT}";              :rem 65
10020 GETI$:IFI$=""THEN10020           :rem 25
10030 PRINT" {LEFT}";:IN=ASC(I$):IFIN=13T
      HENPRINT:RETURN                  :rem 23
10040 IFIN=20ANDLEN(IN$)THENIN$=LEFT$(IN$
      ,LEN(IN$)-1):PRINTI$;:GOTO10010
                                       :rem 67
10050 IF(INAND127)<32ORLEN(IN$)=ILTHEN100
      10                               :rem 250
10060 PRINTI$;:POKE212,0:IN$=IN$+I$:GOTO1
      0010                             :rem 112
```

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Printer Interface Graffiti

I would like to inform the readers about a peculiarity within the Cardco Card/? G+ printer interface. I was playing around with my printer when it printed the following:

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Jackie, This one's for you!
-Breck

Could you please tell me what this means and how I can get this to happen again?

Eric Milota

Most likely, you accidentally triggered the interface into a reset or self-test mode. It's somehow reassuring to discover affectionate graffiti hidden within the high-tech metal heart of a printer interface.

Atari XL Super POKEs

I read in an earlier issue of COMPUTE! that some Atari owners do not like the audible keyboard feedback (keyboard click). You can always turn down the volume, but this prevents you from hearing any other sound effects. This simple POKE will turn off the keyboard click: POKE 731,1. POKE it with a zero to turn the click back on.

Jeff Tjebckes

This POKE works only on the new XL Atari models, not on the original 400/800 computers. There is no easy software solution for the 400/800, but this POKE works fine on the 1200XL, 600XL, and 800XL. There are many other useful POKEs on the XL computers. Remember that none of these POKEs will work with the older 400/800 computers, so if you are writing programs for publication or sharing, keep this in mind.

First try this one: POKE 622,255:GRAPHICS 0. This allows fine scrolling of GRAPHICS 0 screens. Instead of jumping up a line at a time, the screen will smoothly scroll 1/8 character at a time. Use POKE 622,0:GRAPHICS 0 to reset the scroll. You must always follow this POKE with GRAPHICS 0.

POKE 756,204 enables the built-in international character set. Hold down CTRL and press some of the letters of the alphabet to see these new characters. Use POKE 756,224 to go back to the normal character set with the graphics characters. POKE 621,255 disables the keyboard, and POKE 621,0 reenables it. SYSTEM RESET will get you out of this mode if it gets you into trouble. You can read the HELP key with PEEK(732). Location 732 returns a 17 when the HELP key has been pressed. You must POKE it with a 0 to clear it out after you've acted on the key. SHIFT and CTRL also affect the HELP key, returning 81 and 145, respectively.

All keys begin to repeat when you hold them

down. To change the delay before the key begins to repeat, POKE 729 with the number of 1/60 seconds you want to delay. A value of 30 would be a half-second delay. The default is 48, or 4/5 second. A POKE to 730 controls how quickly a key repeats once the repeat has begun. The delay between repeats is also measured in 1/60 seconds. The default here is about 1/10 second.

If you want to take advantage of XL features, yet permit the program to run on the 400/800, you can check the operating system ID byte, found at location 65527 in ROM. There is a different number for every version of the Atari operating system. If this byte returns a value for the 400/800, you can skip over the statements specific to XL models. Consult COMPUTE! Books' Mapping the Atari *for a comprehensive guide to Atari memory, and the article "An Introduction to Atari PEEKs and POKEs" in* The Atari Collection, Volume 1, *due to be released in a few weeks.*

Operating System	PEEK(65527)
400/800 Revision A	221, 87, or 243
400/800 Revision B	230
1200XL Revision A	10
1200XL Revision B	11
600XL	1
800XL	2

Disabling Apple's RESET Key

How do you disable the RESET key on the Apple II+ in BASIC?

Alex Tarlecky

The RESET key generates a hardware interrupt on the Apple, not a software interrupt. However, it's still possible to control the interrupt request by altering the RESET vector at memory locations 1010 and 1011 ($3F2 and $3F3). The value stored in these locations (in low-byte, high-byte form) is set at power-up by whatever program is controlling the Apple. If no disk drive is attached and the Apple has an Autostart ROM, the RAM RESET vector points to BASIC. If there is a disk drive, the computer enters the bootstrap program contained in ROM on the disk-controller card. The value of the RAM RESET vector is usually set by software loaded from the disk.

Autostart ROM only boots the disk on RESET when the computer is first turned on. Other RESETs initiate a jump to the address held by the ROM RESET vector. The operating system uses a code stored in location 1012 ($3F4) to determine if the request for a RESET was initiated by a power-up or not. This code is never properly set at power-up, so a "cold start" results, rebooting the BASIC operating system from the disk. Any program can scramble this code and force a cold start by POKEing a new value into this location.

The code byte at address 1012 ($3F4) must be the Exclusive-OR between 165 ($A5) and the contents of 1011 ($3F3), or a power-up RESET will result.

If your intention is to prevent unauthorized people from LISTing your programs, you could enter this as your greeting (HELLO) program:

```
10 REM AUTO RUN GREETING
20 POKE 1012, PEEK(1012) AND 10
30 END
```

This alters the RESET vector to an invalid number, so pressing the RESET key to interrupt the program forces a cold start, causing the disk to reboot. One disadvantage is that all users, including you, will be prevented from interrupting or listing the program when booting from this disk.

Line 20 could also be included in the program you wish to protect. Pressing the RESET key would cause the disk to reboot, and the altered location would then be correct until the program was run again. But remember that no protection method is absolutely foolproof—this technique will only discourage people from attempting to tamper with your program.

Commodore Tape Sequential Access

I own a VIC-20 and have found that the computer won't recognize a file unless the cassette is set near the beginning of the file. Can this limitation be resolved?

Andy Little

Cassette files are always sequential, and must be read in the same order that they were written. The first part of a tape file is a header containing the filename and other information such as the starting and ending address of a program. Without this header, the computer's Kernal tape routines do not know how to locate and use the data that follows, so you can't just start reading a cassette file partway through. There are ROM routines for directly reading and writing blocks of data to the tape, but the technique is too involved to cover here, and there are many problems with such a method.

Apple/Okidata Graphics Printing

I am using a KoalaPad and am wondering if there is any way you can print pictures produced with *KoalaPaint*. I am using an Okidata 82A printer. Can this printer reproduce computer graphics?

Bob Spachman, Jr.

Koala Technologies offers a package called KoalaPrint *that will print high-resolution pictures to a variety of printers. You may also be able to use other printer dump packages to print KoalaPad pictures. However, your printer does not have high-*

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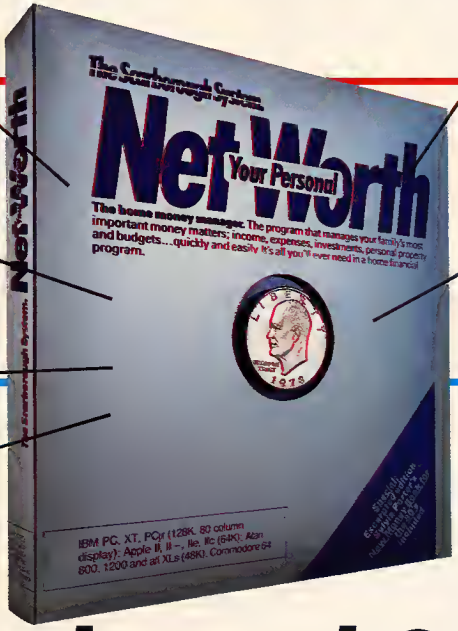

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resolution graphics capability. It can only print TRS-80 style graphics of a resolution of 3 × 2 pixels per character.

IBM PC & PCjr Magazine Correction

There seems to be an error printed in the PCjr version of David J. Bohlke's "Cannonball" game, which ran in the August 1984 issue of COMPUTE!'s PC & PCjr magazine. The program ran perfectly until I blew up RED's cannon, but all I got for an explosion was a line across the screen, then the program crashed. The error was in line 625, which reads:

```
625 W=INT(RND*4+4): W,15,3:FOR J=1
    TO 10:NEXT
```

I think it should read:

```
625 W=INT(RND*4+4): W=15*3:FOR J=1
    TO 10:NEXT
```

It took quite a while to figure out, but I just had to experiment with the program.

Mike Batteiger

Since subscribers of COMPUTE!'s PC & PCjr *magazine now receive* COMPUTE!, *we're publishing the answer here in "Readers' Feedback." The correction you've given will prevent the game from crashing, but the line should read:*

```
625 W=INT(RND*4+4):SOUND W,15,3:FOR
    J=1 TO 10:NEXT
```

We fully tested the program on a PCjr, but we made the listing for the PCjr version of the game on an IBM PC. The PCjr's SOUND command is not compatible with the PC's SOUND command, so the command itself would not list on the PC. Our staff have been alerted to watch for this potential problem in the future.

TV And Tape Interaction

My cousin sent me some programs on tape for my Commodore 64, but they will not load unless I turn off the television set. I've done everything the Datassette manual suggests. Can you offer any advice?

Brian Dorsey

At first, this interaction seems most peculiar. How could your TV have anything to do with your cassette recorder? In fact, though, a television or monitor used with a computer is a primary source of magnetic interference. Although the magnetic field (which can emanate from the TV's transformer) may not erase any tapes or disks, the field can prevent the read head from reading the tape or disk. To solve this problem, move your recorder or disk drive at least two feet away from the television. It's also not a good idea to store tapes or disks within two feet of a television or monitor. And beware of stereo speakers, telephones, and any equipment with a transformer. You may also want to place the power supply boxes on the floor instead of on the same desk or table as your computer.

Commodore Secondary Addresses

I own a Commodore computer and can't find out what the different secondary addresses are for device #2 (the RS-232 port). What numbers do you use here?

Kevin Rose

The secondary address is not really used for opening an RS-232 channel, so you should use a value of zero. Remember that OPENing an RS-232 channel clears out all variables and closes all other files, so OPEN the RS-232 file at the beginning of your program before any variables are defined or DIMensioned. The optional parameters for RS-232 are specified in the filename (we use a file number of 2 here):

OPEN 2,2,0,CHR$(control register);CHR$(command register)

For 300 baud, with a word length of eight bits, one stop bit, full duplex, and no parity, you can use:

OPEN 2,2,0,CHR$(6)+CHR$(0)

Complete tables are given on pages 350 and 351 of the Commodore 64 Programmer's Reference Guide.

Atari 800XL Memory Expansion

Can you use the memory expansion intended for the 600XL to expand the memory of the 800XL?

Toby Buckalew

The 600XL memory expansion brings the total memory of the 600XL up to the maximum of 64K. Although it would plug into the 800XL, this would be futile (and would confuse the computer), since the 800XL already has 64K. Memory is not merely an add-on item—it has to fit correctly into the computer's memory map. Since the memory map is full on the 800XL, you would need some other kind of expansion memory that uses bank switching or windowing to get more than 64K of system memory. You could never have more than 64K of memory at one time, but you could swap out (bank switch) portions of the expanded memory in a cartridge that allows this. Don't expect any commercial software to take advantage of such an unusual memory configuration, though.

Commodore Plus/4 Peripherals

I own a Commodore 64, Epson RX-80 printer with a Tymac Connection interface, and an MSD

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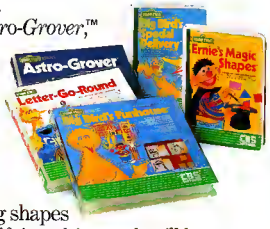

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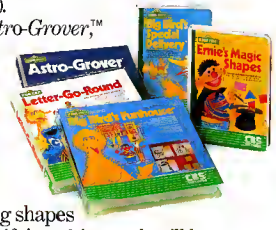

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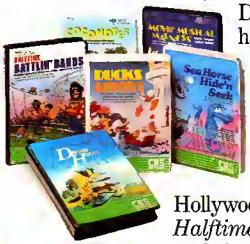

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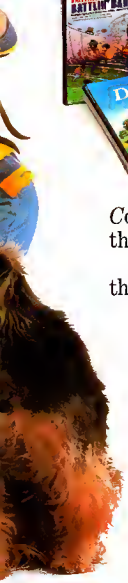

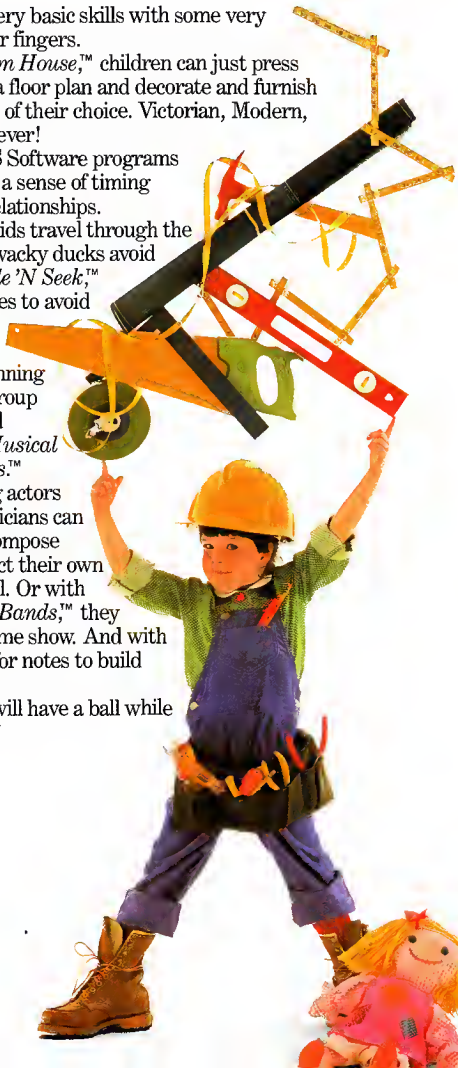

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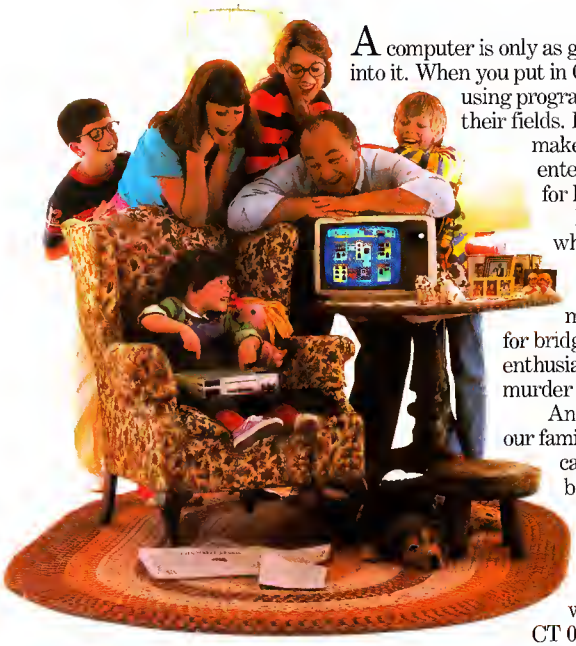

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single disk drive. If I purchase the new Commodore Plus/4, will I be able to use my 64 peripherals with it? Will my Commodore 64 software work on the Plus/4?

Otis Smerd

The Plus/4 uses a redesigned cassette jack, so you will not be able to use an existing Datassette with the Plus/4. As long as the printer interface does not use the 64 cassette port for power supply, it will work with the Plus/4. Almost any device using the round serial port, including your disk drive, will also work with the Plus/4. The Commodore 1702 color monitor is also compatible with this computer via the rear connections. Unfortunately, you can't use your 64 or Atari joysticks with the Plus/4 (even though the joystick circuitry is compatible) since the Plus/4 uses a proprietary joystick port. Perhaps Commodore or a third-party manufacturer will sell joystick or cassette port adapters.

Although the Plus/4 uses the same type of microprocessor and similar operating system as the 64, the hardware is not compatible with 64 software. Few 64 programs will run on the Plus/4, just as you can't readily transfer software between the VIC and 64. Some 64 (or VIC) BASIC programs that avoid PEEKs, POKEs, and machine language will load and run on the Plus/4, but you'll have to convert most programs yourself. Since the peripherals are compatible, the ideal solution is to own both *computers.*

Atari Attract Mode

I own an Atari 1200XL. So far, I have programmed two games in BASIC, but there is one problem I haven't solved. After about 8–10 minutes of play, the screen starts to change colors. Is there any way to get around this annoyance? Also, I heard that Atari has a contest for amateur programmers. Have you heard anything about this?

John Hnat

The Atari computers incorporate the color shifting to protect the screen from damage. Normally, you have nothing to worry about, since TV images change constantly, but theoretically an image could burn itself into the phosphor if left displayed unchanged for a long period of time. Back in the early days of Atari computers, rumors about this problem were seized upon by the public and blown all out of proportion. To allay fears, all Atari machines have this color shifting protection built-in. If the keyboard has not been touched for 8.5 minutes, all the colors cycle at a reduced brightness. This constant color shift prevents any one image from burning into the TV screen. However, we have never seen a documented case of a home computer damaging a television due to long exposure. Incidentally, the color shifting is called attract mode, *named after the way arcade games will play automatically to attract customers.*

Every four seconds, memory location 77 is incremented by one. When it reaches 128, attract mode starts. To prevent attract mode, POKE 77,0 periodically. If you want to preserve the intention of attract mode, perform this POKE only when the player makes some action, as in moving the joystick. If you are playing a game that does not disable attract mode, you can press any key to stop the color shifting. Sometimes a keystroke interferes with a program, but you can often press the inverse video key (which doesn't generate an ATASCII keystroke) twice to cancel attract mode while a program is running.

The Atari Program Exchange (APX), which has been recently discontinued, was a potpourri of user-written programs. You would send your program for consideration. If it was good enough, Atari would market your game through the APX catalog. There were also quarterly prizes in several categories for the best programs received, and the famous Atari Star award was given once a year for the best program overall. The prize money ($25,000) gave the first Atari Star winner Fernando Herrera the impetus needed to start his own software company, First Star Software. IBM has started a similar mail-order service for the PC and PCjr, called Personally Developed Software.

Microsoft BASIC Variable Annihilation

When my program stops on an error, I edit the offending line, intending to CONTinue after I've made the change, but am amazed to find that changing a program line clears out all variables. I have to rerun the program and enter all the lost information every time I make a change. Why does this happen, and how can I get around the problem?

John H. Leonard

This problem, which is endemic to Microsoft BASIC (Atari BASIC preserves variables when you change a line) cannot be readily overcome. Variables are stored in memory immediately after the last line in your program. When editing or entering a line, the final program could become larger, and would overwrite some variables, turning them into an unseemly binary mush. BASIC could move the variables when a program changes size, but the designers of Microsoft BASIC decided to just clear all the variables.

Commodore Repair Tips

I am a Commodore owner, and am running a repair shop for Commodore equipment. I wanted

to pass on a few tips to your readers. First, about 90 percent of all machines are returned due to a blown fuse. This causes a blank picture, even though the power LED still shines. The fuse is easy to replace if you can open the case. The second biggest problem is due to a blown PLA (programmable logic array) chip. Unfortunately, I have not been able to obtain parts from Commodore, and am relying on used and broken 64s for spare chips. Also, I welcome any questions on repairs or simply on how things work.

Steve Fogolini
8232 Richard Street
Fort Worth, TX 76108

We're publishing your address so that interested readers can contact you, but be ready for a deluge of mail. Also, readers should beware that they will void their 90-day warranty by opening or tampering with the computer. We have over a dozen 64s in-house, and if a 64 goes bad, it is indeed usually the result of a blown fuse or a damaged CIA (Complex Interface Adapter) chip. It's easy to destroy the CIA merely by touching the exposed joystick port (which is connected to the CIA) in a static-prone environment. As you said, though, Commodore is reluctant to supply individuals with replacement chips.

Backing Up the Atari Macro Assembler

Due to built-in limitations, you can copy the *Atari Macro Assembler/Editor* (AMAC) package to another disk, but the copied program will not run. This prevents you from making a backup copy for archival purposes. Additionally, it is inconvenient to have to switch between the AMAC disk and your program disk when you are assembling from disk. It's easier if you can copy the assembler to the same disk as your source code files. Fortunately, this problem is easy to fix. First copy the file "D:AMAC" to another disk, then run this small program. It makes a small change to the assembler, so that the copy will work properly.

James A. Tunnicliffe

```
10 OPEN #1,12,0,"D:AMAC":FOR I=1 TO
   8:GET #1,A:NEXT I:PUT #1,208:PU
   T #1,34:CLOSE #1
```

Thanks for the modification.

Apple Trigonometry

I was planning to do my trigonometry homework on my computer. I have an Apple II+ and wanted to use the functions SIN, TAN, and COS. I had assumed that the number you put into the parentheses was the number of degrees of an angle, but when I tried it this way the result was not the same as the number on my chart. It didn't agree with COS, SIN, or TAN. So I looked up these functions in my user's manual, but they gave some explanation about radians and other things I could not comprehend. Could you please give me an understandable explanation of what these functions do?

Chuck Knakal, Jr.

The trigonometric functions on the Apple II+ as well as most other computers use radians instead of degrees to specify an angle. Most of us are accustomed to measuring angles in degrees, but radians are actually easier to use when performing complex calculations. Radians are based on the mathematical relationship between a circle's diameter and its circumference. Degrees, on the other hand, are arbitrary and as a result are cumbersome to deal with in calculations.

If you prefer to think in terms of degrees instead of radians, the following table will help you translate between the two.

Degrees	Radians
0	0
90	$\pi/2$
180	π
270	$1.5*\pi$
360	$2*\pi$

(Where π is approximately 3.1416.)

The following formulas can be used in your program to convert from radians to degrees and vice versa:

Radians=degrees*3.1416/180
Degrees=radians*180/3.1416

Here's a program that will calculate the SIN of any angle specified in degrees:

```
10  INPUT "ANGLE IN DEGREES:";D
20 R = D * 3.1416 / 180
30  PRINT "SIN="; SIN (R)
```

TI-99/4A Character Memory

Recently I came across something on my TI-99/4A which I don't understand. With Extended BASIC installed and no program in memory, I defined a character from 127 to 143 with the CHAR subprogram. I then typed NEW and SIZE (to give the amount of memory available). I found no memory had been used although the character remained redefined. Can you explain this?

Chris Teixeira

In Extended BASIC, the SIZE command returns the number of bytes left for BASIC programming and variable storage. Character codes for characters from 127 to 143, however, are stored in a separate protected area of memory. This is why you observed no

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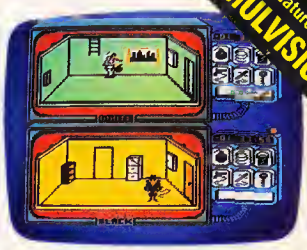

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difference in the memory available for programming after you defined a character in this range.

Since the area of memory used for defining characters 127 to 143 is not affected by the BASIC program, it can be used to pass variable values between programs. Variable data need only be coded into a 16-character hexadecimal string (a pattern identifier). CALL CHAR is used to store the string (which can hold eight bytes), and CALL CHARPAT will retrieve the string. For details on this method, see "Transferring Variables in TI Extended BASIC" by Patrick Parrish in COMPUTE!'s TI Collection, Volume 1.

Atari USR

I own an Atari 600XL, but don't have a complete manual. What does the USR statement do? I've seen it in several programs, such as A=USR(1536). What is the 1536 for? Why can't you enter USR(710) to change the color of the screen?

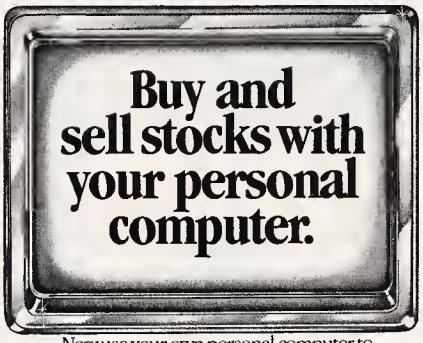
USR looks like any other BASIC function, but is the gateway from Atari BASIC to machine language. It does not work like POKE or PEEK, which can be used to change and read memory locations like 710, which holds the background color of a GRAPHICS 0 screen. An understanding of machine language is essential in creating your own USR calls, but there are many plug-in subroutines (published in our books and in COMPUTE!*) that you can add to your program.*

For machine language programmers, USR lets you pass parameters (variable values or expressions) to the machine language program. A=USR(n,x,y,z) would start the 6502 executing the code at memory location n *(instead of executing the BASIC interpreter). Since there are three parameters in the example, the number 3 will be the first item on the 6502 stack (use PLA to read a byte off the top of the stack into the accumulator). If there are no parameters, a zero is used, and you must pull this zero off before you use RTS to return to BASIC. The rest of the parameters are converted to 16-bit unsigned integers, and placed in order on the stack. Each parameter becomes a two-byte number which is found on the stack high byte first, then low byte: The stack after the call A=USR(1536,5,65535,2562):*

Top of stack:	*3*
	0
	5
	255
	255
	10
	2

The next two bytes are the return address—1 of the BASIC interpreter, since JSR (which is how USR calls the ML) stores this address on the stack.

Since USR is a function, you can't use it by itself, but must use a statement like X=USR(1536). The actual variable you use doesn't matter, but the ML program can pass a value back to BASIC by storing the low byte of the number in $D4 and the high byte in $D5. This value will be assigned to the variable used in the USR statement. ©



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Quick.

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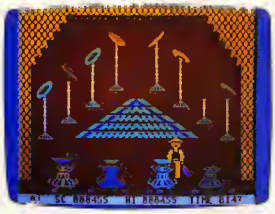

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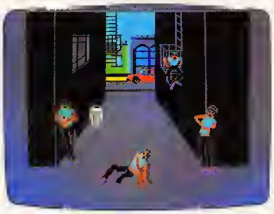

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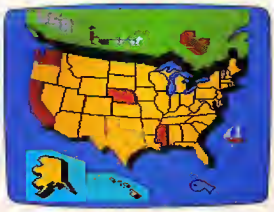

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Controlling Your Home By Computer

Sharon Dorling, Research Assistant

In the cartoon home of George and Jane Jetson, computers controlled everything from preparing meals to walking the dog. While such a supercomputerized house seems somehow overkill, reality has begun to catch up to the Jetson fantasy. There are some serious applications for the home. Your computer can connect to a variety of devices which let you control alarm systems, monitor heat and air conditioning, start your dishwasher, and even activate your coffee pot in the morning.

If we were still in the energy crisis mind-set of a few years back, William Brayden might now have more business than he could handle.

His company, Savergy, Inc., sells two control devices he developed for the Commodore 64 which will monitor and control energy use. While he estimates a homeowner can save at least 25 percent on energy consumption by using control devices, he says sales of his Computer Interface Module 112 have not been as great as he initially expected.

"We've seen a considerable attitude change in the last year," says Brayden, who has been in the energy management field since 1978. "It's like when gas first went up from about 30 cents a gallon to a dollar—everybody screamed about it, but nobody's screaming about it today. It's the same thing with home heat and energy—they were screaming about it like crazy. Now a lot of people tend to accept it rather than do something about it."

Brayden remains convinced, however, that computer owners who don't take advantage of their computer's capabilities to help control their homes are missing excellent opportunities to save money.

Savergy's Commodore Systems

Brayden offers two methods of cutting costs, both of which use the Commodore 64 or VIC-20 as controllers. Savergy's CIM 112 ($479) is dedicated to controlling large appliances such as water heaters, washing machines, air conditioners, and the like. The Powerport ($99.95) turns lights on and off, controls lawn sprinkler systems, and even operates the percolator.

"You're never going to be able to do any serious energy management by controlling lights and coffee pots—you have to be able to control the high power loads that are really eating up the electricity," Brayden says. So, while devices hooked up to small appliances and controlled by your computer can be convenient, they're not going to save you much money.

Brayden's software uses time-of-day scheduling and duty cycling to conserve energy usage. With duty cycling, an appliance such as an air conditioner can be turned on for a preset number of minutes, then turned off. The cycle would then be repeated. With a traditional system, the air conditioner runs continuously, until the desired temperature is reached.

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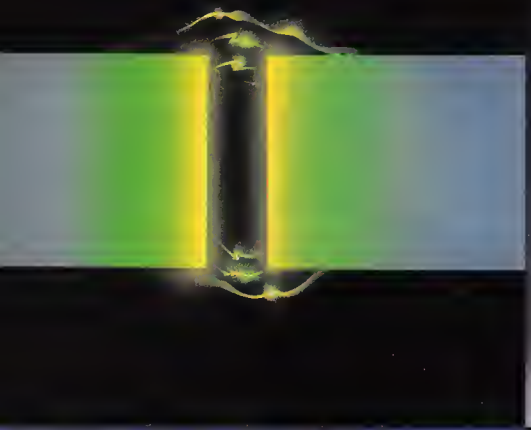

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Brayden explains that with duty cycling, the temperature "kind of peaks out in a nice, round peak and then tends to start tapering off—it doesn't immediately drop down to its off temperature, so if you turn it on for four minutes, and turn it off for one minute, you have an 80 percent duty cycle."

Apple, IBM, Commodore Connections

During that one minute off-time, heat or air conditioning would still be radiating throughout the house, Brayden says, but for free, since the compressor would not be operating. "The combination of turning things off through scheduling when you don't need them on, and duty cycling them if they are appropriate for that, is how we very conservatively came up with the 25 percent savings," he adds.

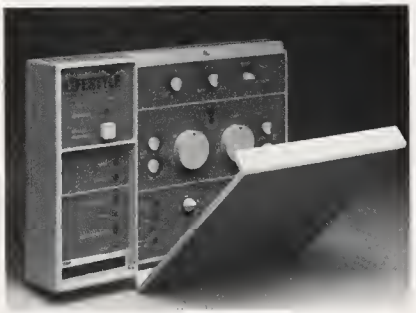
A simple computer control system might begin with appliance controllers, since they are fairly inexpensive and relatively easy to install, says James Coffron, author of several books on computerized home control, including *The IBM PC Connection*, *The Commodore 64 Connection*, and *The Apple Connection* (Sybex).

Coffron estimates that a person could set up a simple system, using a Commodore 64, for around $200.

The heart of most control systems for small appliances and light switches is centered in modules (available from BSR Ltd. and Leviton Manufacturing Co., among others) which plug into the wall, and receive instructions from a computer. Your computer sends a signal which is received by the BSR module. The results, for example, may be that the lights are dimmed, the stereo starts playing music, the coffee pot turns on, or any of a hundred other computer-activated chores are carried out. (For more do-it-yourself information, see COMPUTE! Books' *Home Energy Applications On Your Personal Computer*.)

The Genesis Controllers

Another firm which makes a series of home control products that can be used separately or together is Genesis Computer Corporation. The products run on either the VIC-20 or Commodore 64.



ESI's SavIt is an automatic temperature control system which contains its own computer.

Genesis' VIController ($69.95) is a plug-in unit with software on disk which is used in conjunction with remote BSR-type switches to automate appliances and lights through time-of-day scheduling.

The firm's COMsense device (also $69.95) allows doors and windows to be hooked up to the computer. Used in combination with the VIController and magnetic reed switches, a simple home security system can be set up.

Let's say you want to have your computer flash the lights on and off if a door or window is opened. The magnetic reeds (available inexpensively from hardware or appliance stores) are attached to the doors and windows that are to be monitored. When the connection is broken, the reeds send a signal to COMsense, which in turn delivers a message to the VIController. The controller then flashes the lights.

COMsense can also be programmed to sense such things as air or water temperature, ground moisture, and humidity. With that type of information, the VIController would know to turn on the lawn sprinkler when the moisture level drops below a certain point or turn on the heater when the temperature falls.

Another Genesis product, the COMclock ($69.95), is a battery-powered, realtime clock which contains its own ROM chip. It connects to the Commodore 64 through the expansion port, and can automatically reboot the software used by the VIController if there is a power failure or interruption. Savergy's products are compatible with COMsense and COMclock.

Do-It-Yourself Transducers

For real do-it-yourselfers, another way to build a home security system is with *transducers*, says Coffron. Transducers sense physical information, such as a door being open, and send an electrical signal that the computer can understand.

Depending on what type of program you've designed for your security system, any one of a number of actions can be programmed: An alarm can sound, lights can start flashing, or your computer can automatically dial law enforcement authorities, via modem, alerting them to the break-in.

Software also can be used to schedule the times at which appliances and lights are turned on and off.

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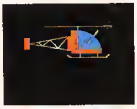

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Designed by Garry Kitchen.

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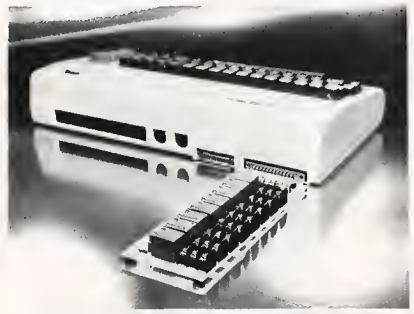
mechanical genius to put such a system together, Coffron adds. "That had a lot to do with why I wrote the books," he says. "To show that you don't need to be a genius." Installing transducers and BSR modules is "a pretty straightforward kind of thing, and the wiring is like putting up speakers for your stereo—everybody takes that as a pretty mundane function," Coffron says.

But do you want to dedicate your computer to just controlling your home?

An alternative many people opt for is to buy a relatively inexpensive machine, such as the VIC-20 or Commodore 64, and use it solely for home control. Coffron says he designed the systems diagrammed in his books to be used at times when the computer was not needed for other functions.

With the VIController, the computer can be used for other programs, once the time-of-day scheduling software is up and running, says Randy Brust, vice president of Genesis.



The Powerport from Savergy, Inc., plugs into the user port of a Commodore 64 to control appliances.

The High-End Future

For people interested in an entire home control system, there are several high-end products which come complete with their own microprocessors. While their costs are significantly higher, they point the way to what will surely be the home control formats of the future.

Electronic Systems International has introduced the $898 Savlt Lifestyle energy control computer, which monitors heat and air conditioning use. The system can reportedly save up to 42 percent on a home's or small business's annual heating and cooling costs.

The computer electronically senses the temperature, as well as temperature changes. It checks the temperature every 1-1/2 seconds, and automatically adjusts the heating and air conditioning for different times of the day.

Another control package, the HomeBrain Intelligence System, controls and monitors energy consumption, security and fire safety, environment, and lighting and appliances. Produced by HyperTek Incorporated, HomeBrain lets you program the variables you desire for temperature and light sensors, sirens, switches, and motion sensors. Once these are set, a personal computer isn't needed with HomeBrain. The unit's CPU takes care of the rest. Up to 300 different switch-controllable devices can be hooked up to HomeBrain, although not all simultaneously.

The system has a variety of subtle monitoring formats. For example, a rain sensor can make sure that the lawn is not watered during a rainstorm. Motion detectors can tell when the house is empty, so that heat or air conditioning won't run needlessly when no one's home.

At $1499 suggested retail, the HomeBrain system isn't cheap. The manufacturers estimate a three- to five-year payback, with energy savings of 10 to 30 percent.

HyperTek also makes an enhanced package, complete with software and peripherals, which retails for $2149. That system is preprogrammed for a typical house, says Eric Davidson, director of marketing at HyperTek.

That Warm Feeling

Brust and Coffron agree that one of the most popular uses for computer control devices is home security. It offers an intangible psychological benefit, Coffron says—peace of mind.

"It gives you a warm feeling that everything is as it should be."

While it may be a somewhat exacting process to start a computer-based home control system from scratch, both Coffron and Brayden foresee a

BSR Ltd.
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Blauvelt, NY 10913

Electronic Systems International
2797 Peterson Place
Norcross, GA 30071

Genesis Computer Corporation
P.O. Box 1143
Bethlehem, PA 18018

HyperTek Inc.
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Whitehorse, NJ 08888

Leviton Manufacturing Co.
5925 Little Neck Parkway
Little Neck, NY 11362

Savergy, Incorporated
1404 Webster Avenue
Fort Collins, CO 80524

For the books The IBM PC Connection, The VIC Connection, The Apple Connection, *and* The Commodore 64 Connection, *by James Coffron, contact:*

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time when houses will be built with computers already installed.

"I firmly believe that within five to ten years, builders will start building a computer nook into a home, and at that point, it becomes very feasible to have your so-called black box [controller] sitting next to that home computer," Brayden says.

Coffron predicts that homes in the not too distant future will have computer jacks in every room, the way electrical outlets and telephone jacks are commonplace now. Along with the jacks, "there will be interfaces for whatever computer you have, and they'll be tied in to wiring all over your house, so you really won't have to do anything but run your home security package, or run your home control package." ©

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*Standard matrix printers require an intelligent graphics interface such as the Micro-World MW-350, Tymac Connection, or others.

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Personal Finance Made Simple

Kathy Yakal, Feature Writer

No matter how much money you earn, it never seems enough. Stretching your income to pay for everything you need, and still putting a little away for retirement, often require the services of an accountant. But thanks to recent personal finance software for your computer, the accountant's fee may be one expense you can forego.

Andrew Tobias, best-selling author and financial guru, watched through a one-way mirror as people tried using his new home finance software. Unlike most such programs, Tobias's package has personality: It incorporates his dry wit as well as his financial talents. The program is comprehensive, easy-to-use, and entertaining. As Tobias anonymously observed the final consumer testing, everything seemed to be going well and the responses were favorable.

Then one of the test customers raised an objection. After using the program for a while, he announced he would never buy it. "It's got a sense of humor," he said. "Money is a very serious matter."

No pain, no gain. If it tastes bad, it must be good for you. Keeping track of personal finances is something that many of us have always assumed must be painful. But now a home computer can help ease that burden. Personal budget programs, ranging from simple checkbook-balancers to complete financial packages, are simplifying money matters for thousands of people.

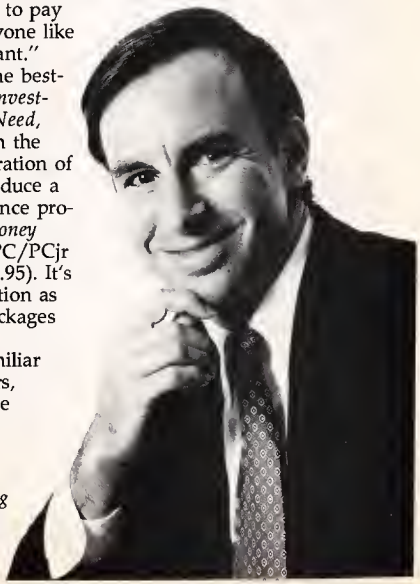
Who needs it? "Anyone who is motivated and forward-looking, because people who have no interest in the future and aren't motivated don't buy computers," says Tobias.

"Anyone who fits that profile by definition has the intelligence, motivation, and financial needs. They may not have a lot of money, but they have earning power and they have a future they're trying to plan for, and they certainly have to pay bills and pay taxes. Anyone like that is a suitable applicant."

Tobias, author of the best-selling book *The Only Investment Guide You'll Ever Need*, recently teamed up with the Micro Education Corporation of America (MECA) to produce a sophisticated home finance program, *Managing Your Money* (available for the IBM PC/PCjr and Apple IIe/IIc; $199.95). It's quickly gained a reputation as one of the best such packages on the market.

Though he was familiar with personal computers, having bought an Apple III a few years back, Tobias was doubtful whether a home computer could handle a comprehensive financial package. "I kept saying, 'Can it do all that?' And they kept telling me, 'Forget what it can do. Just tell us what you want it to do.'"

He found out the computer could do everything he wanted. "My idea was to have a place in the program for everything that a family would have—short of the Rockefellers and Mellons—anywhere from middle class to upper-middle class. What does a family like that have? Checking and savings accounts, budgeting



Andrew Tobias, best-selling author and designer of Managing Your Money, *an acclaimed financial package.*

and charge accounts, stocks and bonds, insurance, taxes, investment and loan analysis, and retirement planning. I threw in a reminder pad and net worth analysis. Basically, I just looked at my book and said, 'What's in here that I just talked about in terms of advice?'"

The program turned out, he thinks, better than a book. "Far from just telling someone, 'Gee, you should make a budget,' we actually give them something that will help them make a budget and keep up-to-date. This thing is a utility. It actually does things. [It's] the difference between a cookbook that gives you recipes and a kitchen that has seven or eight appliances and each of them does things. This will keep records, generate reports, calculate things, put into action what you would have had to do with a pencil and paper after reading a book."

And it does all of those things with virtually no documentation. The manual accompanying the program basically tells you how to get the program running; once you've accomplished that, everything you need to know is explained by the software itself.

Managing Your Money is but one of dozens of new home finance programs. Varying in sophistication from simple budget-balancers to full-blown financial forecasters, they may be one of the most practical software investments you can make, claim their publishers.

"One of the things people want to do early on is button down their finances," says Ken Currier, vice president of Softsync. "I think they feel that's a good primary use for their computer, something they can get tangible results with."

Softsync started out developing software for the Timex/Sinclair. A few years back, the company published a very simple checkbook-balancing program and was amazed when it sold 80,000 copies. Then, recalls Currier, they realized that people might be interested in using computers for fairly serious financial purposes. But the challenge was to strike a good balance between true usefulness and the work involved in maintaining a budget on a computer. "Checkbook programs aren't really that useful," admits Currier. "That tends to be a lot easier with pencil and paper. On the other extreme, nobody I know really needs accounts payable and accounts receivable and other business stuff like that."

So they sat down with a bank manager who also happened to be a computer programmer and talked about what kind of features would be helpful to the typical home computer owner. The result was *The Personal Accountant* (available for the Commodore 64 on cassette and disk for $29.95 and $34.95; and for the IBM PC/PCjr and Apple IIe/IIc for $49.95). *The Personal Accountant* keeps track of income and expenses with a double-entry bookkeeping system. "The process is really quite simple," says Currier. "You don't have to know anything about accounting. All you have to know is that money comes from one place and goes to another."

In addition, *The Personal Accountant* can provide professional financial reports listing assets and liabilities, income over expense, and trial balances, reports that can help prepare tax returns. An amortization section and integrated data base manager complete the package.

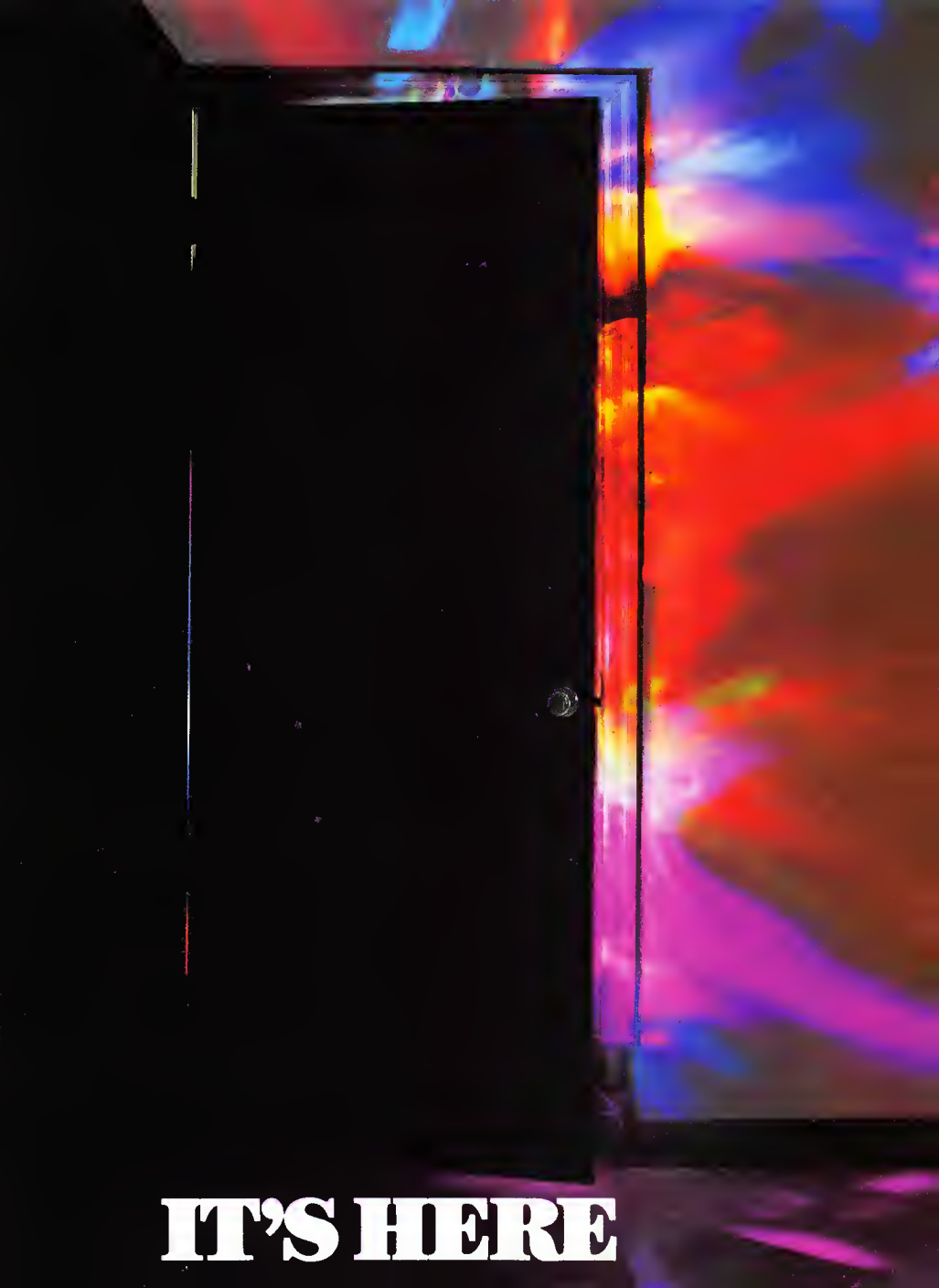
Another program, *Personal Money Matters*, by Avante-Garde Publishing Corporation, is designed to both simplify

Tobias's Managing Your Money *program is spiced with subtle wit, such as this quotation on a reminder pad screen.*

bookkeeping and facilitate long-range forecasting. (It's available for the Apple II series, $79.95; IBM PC, $99.95; and soon for the Commodore 64.) Each segment of the program comes on a separate disk. *Budget Master* balances bank and credit accounts, sets spending priorities, and monitors expenditures. *The Organizer* keeps an inventory of all valuables, household goods and properties, as well as important dates, payments, and special transactions. And *Investment And Loan Calculations* lets you explore various investment opportunities and compare options.

Tom Measday, vice president of marketing and sales for Avante-Garde, says *Personal Money Matters* is aimed at people relatively new to computers, generally upper-middle class families. "The kind that keep decent financial records on paper," he explains. "The computer helps them do something they already know how to do."

A personal finance program may be one of the most difficult types of software to design—people have a tremendous variety of financial needs and ways of taking care of them. "It's hard to make the software flexible enough that people can suit it to their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QUESTIONS & ANSWERS

Q: Why do I need a printer?

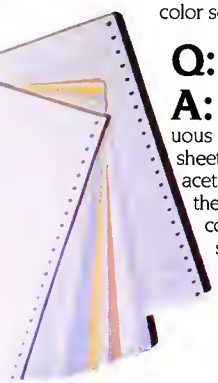
A: You might as well ask, "Why do I need crayons?" When it comes to communicating, "putting it on paper" is still the best way to get your message across. You can have lots of computer equipment, but without the OKIMATE 10, it doesn't mean very much. Unless you get your letter, report, term paper or party invitation off the screen and down on paper, nobody's going to see it.

Q: What makes the OKIMATE 10 better than any other printer?

A: Because the OKIMATE 10 is unlike any other printer. First, it prints in COLOR. Up to 26 beautiful colors. Second, it prints up to 240 words a minute, so quietly you can talk in a whisper right next to it and still hear every word! And third, it prints letter quality, every time.

Q: What about graphics and pictures?

A: The OKIMATE 10 does it all. Graphs, charts, symbols, pictures, illustrations, and special drawings! With a compatible drawing package, anything you create on your screen can be printed in full color; a disk drive is required for color screen printing.



Q: What kind of paper can I use?

A: Just about any kind of smooth paper you want. From continuous feed computer paper to single sheets. From mailing labels to plastic acetate for overhead transparencies, the OKIMATE 10 prints crisp, clean, colorful images you'll be proud to send to friends, teachers, business associates, or frame and hang right in your own living room!

Q: Is the OKIMATE 10 easy to use?

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Q: What's the printer like in operation?

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Q: What about reliability?

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Available at retailers everywhere.

needs," says Tobias. "If it's too rigid, you'll hit only a certain amount of people who want to do it your way. You have not only the complication of the computer, which is daunting, but most people find personal finance daunting."

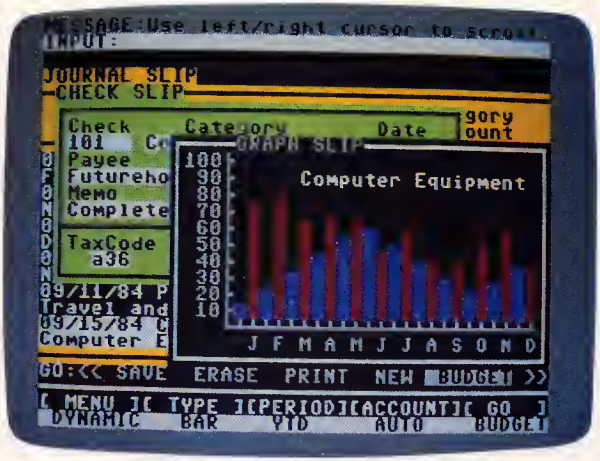
Yet, Tobias doesn't advocate a separate program for each purpose. "Any program that just does one thing, especially if it's just a checkbook program, is a toy. You don't need a computer to balance your checkbook. The bank has a very big computer that does a good job itself of balancing things."

(Besides, Tobias confides, you don't really need to balance your checkbook. "I never balanced a checkbook in my life. I just look to make sure all the checks are mine—I once got 15 checks from a Chinese laundry—and that no one has forged my signature. And I take a very quick look down to see that all my deposits have been credited. You know in a vague sort of way what the balance is supposed to be.")

Because people's financial needs and options constantly change, most publishers of financial software frequently revise their packages. "Actually, any good software product should be updated every 12 to 18 months," says Avante-Garde's Measday. "You not only need to ask people upfront what they want by doing extensive beta-testing [testing software with consumers], but you need to keep checking along the way."

Software publisher Futurehouse tackles that problem by mailing bimonthly newsletters to its customers and maintaining a technical support hotline. Futurehouse recently released the third version of its popular Commodore program, *The Complete Personal Accountant.*

To ease the transition from shoebox accounting to home



Futurehouse's Complete Personal Accountant *brightens up bookkeeping with lavish use of color graphics and overlapping screen windows.*

computer accounting, the latest version of *CPA* incorporates lots of graphics, windows, and icons. It even uses screen graphics to make checks, deposit slips, and credit card receipts look like their paper counterparts. "What's wrong with making a check look like a check?" asks Andrew Hock, vice president of Futurehouse.

"I think you're going to see a lot more financial packages using things like icons and windows in the future," adds Hock. "They're a lot more user-friendly, and they require less documentation. After all, that was the whole idea behind the Macintosh."

Home finance software won't make you rich, and it won't automatically run your household, either. You'll still need to spend some time filling in the blanks on the screen. That's the chief drawback of most checkbook-balancing programs. It's far more work to enter all the data into the computer than it is to keep your checks on file and balance your books with a pocket calculator.

For a personal finance program to be practical, the benefits must outweigh the labor required. Entering information "has to be very fast. Otherwise, why bother?" says Softsync's Currier. "At the end of the month, you should be able to sit down with all your receipts and within 20 to 30 minutes have everything in, maybe run a couple of reports and see where you are each month."

"It's worth it," says Andrew Tobias, "even if someone only uses it five or six times a year, maybe for tax hypotheses and rental property analysis. For those people, it would basically be the ultimate pocket calculator. But for most people, I would hope they'd use it once a week. You can get the same work done as before, but it will be under control, instead of having the whole thing pile up in a shoebox."

There are dozens of personal finance programs, and space doesn't permit us to list all of them. But here's a selection of what's available for various brands of computers.

The Home Accountant
Arrays, Inc./Continental Software
11223 S. Hindry Avenue
Los Angeles, CA 90045
IBM PC $150.00; PCjr $74.95; Apple II series, TRS-80, Atari, and Commodore 64 $74.95.

Personal Money Matters
Avante-Garde Publishing Corporation
P.O. Box 30160
Eugene, OR 97403
Apple II series $79.95; IBM PC $99.95; soon available for Commodore 64.

Dow Jones Home Budget
Decision Support Software, Inc. and Dow Jones & Co., Inc.
Dow Jones & Co., Inc.
P.O. Box 300
Princeton, NJ 08540
IBM PC $139.00

Financial Cookbook
Electronic Arts
2755 Campus Drive
San Mateo, CA 94403
IBM PC/PCjr, Apple II series, Commodore 64, and Atari $50.00

Complete Personal Accountant
Futurehouse
P.O. Box 3470
Chapel Hill, NC 27514
Commodore 64 $79.95; $20.00 additional for technical support.

Managing Your Money
Micro Education Corporation of America
285 Riverside Avenue
Westport, CT 06880
Apple IIe/IIc, IBM PC/PCjr $199.95.

MicroCheck
Microbits Peripheral Products
225 3rd Avenue S.W.
Albany, OR 97321
Atari and Commodore 64 $49.95.

Dollars and Sense
Monogram
8295 La Cienega Boulevard
Inglewood, CA 90301
IBM PC/PCjr $179.95; Apple Macintosh $149.95; Apple IIc $119.95; Apple II/II+/IIe $100.00

Your Personal Net Worth
Scarborough Systems, Inc.
25 N. Broadway
Tarrytown, NY 10591
IBM PC/PCjr $99.95; Apple II series, Commodore 64, and Atari $79.95.

The Personal Accountant
Softsync, Inc.
14 E. 34th Street
New York, NY 10016
IBM PC/PCjr, Apple IIe/IIc $49.95; Commodore 64 disk $34.95 and cassette $29.95.

64-Accounting System
Software Design, Inc.
P.O. Box 570
Waterloo, IA 50704
Commodore 64 $69.95.

Money Manager
Timeworks
P.O. Box 321
Deerfield, IL 60015
Commodore 64 $24.95; IBM PC/PCjr $59.95; Apple II series $39.95. ©

Wizard of ease.

Easy user.

Letter Wizard is an ideal word processing program for even the most serious wordsmith in your family. It boasts a spelling checker and compatibility with all popular printers. Nice thing is, commands are a whiz to learn and perform.

Easy writer.

Compose and edit right on the screen. At the stroke of a key, you can move, delete, insert, search and replace words and paragraphs like. . .well, magic.

Easy speller.

Letter Wizard includes a spelling checker which allows easy in-line corrections of over 33,000 words. And you can even create custom dictionaries of your own special words. Have we got you under our spell yet?

Easy buyer.

OK, a powerful program like this must cost a powerful lot of money, right? Stuff and nonsense. Even though Letter Wizard offers more than most, it costs less than most. And that's no voodoo.

For Commodore 64, Apple II and Atari systems.

Letter Wizard™ with Spelling Checker by Datasoft®

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DesignWare programs provide multiple levels of challenges, which let Jennifer continue to grow long after she first starts to use each program.

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So Jennifer's parents can tailor her DesignWare program to match her homework assignments. Or Jennifer can change her program to challenge her parents.

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DesignWare offers programs for children ages 4 to 16, and for parents of all ages.

They cover a wide range of important subjects including math, geometry, algebra, geography, vocabulary, spelling, grammar, history, computer literacy, and music.

And they run on Apple,® Atari,® Commodore 64,™ IBM® PC and IBM® PC Jr. For the name of your nearest dealer or to order our free catalog, call us toll-free at (800) 572-7767. (415-546-1866 in California.)

DesignWare®

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MSX IS COMING

Part 1

Tom R. Halfhill, Editor
Selby Bateman, Features Editor

More than a dozen consumer electronics and computer companies—primarily Japanese—are gearing up to enter the U.S. market in early 1985 with new inexpensive home computers designed around the so-called MSX standard. What is MSX, and what does it mean for American computer companies, software publishers, and consumers? We'll examine these questions in this first installment of a special two-part series.

A giant silicon-based question mark is rising on the Far Eastern horizon. The shadow it casts is stalking the U.S. home computer industry, and millions of dollars in future sales hang on how far it creeps. Depending on your point of view, it will either brighten the market for everybody or darken the future for American competitors. One way or the other, its arrival on these shores will help determine the course of the consumer electronics and home computer industries for years to come.

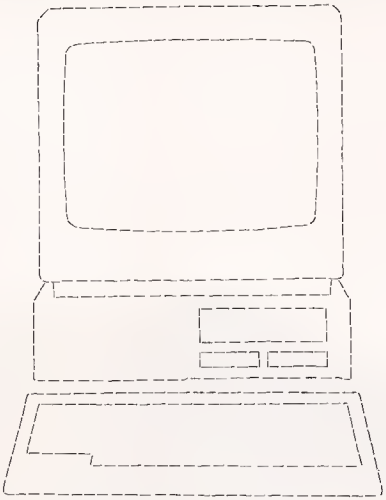
The question mark is something called MSX, and it's an enigma waiting for answers. Will it signal the first successful Japanese invasion of the U.S. home computer market? Will it establish the long-awaited standard among home computers? Will it banish the confusion over home computing and make computers as widely accepted and popular as TV sets and stereos? And finally, how will American manufacturers react to the Japanese invaders? Will they try to beat them, or shrug their shoulders and join them?

Mindful of past Japanese takeovers (or near-takeovers) of the U.S. camera, motorcycle, audio, video, auto, and steel industries, the leading American computer firms are watching MSX very closely. Powerful Japanese consumer electronics companies with such familiar names as Sony, Yamaha, Panasonic, Sanyo, Hitachi, and others have been planning their MSX strategies for more than a year and a half. Their target: the tens of millions of Americans who still haven't bought a home computer, plus millions more who perhaps already own a computer but are confused and frustrated by a mishmash of conflicting nonstandards and incompatibilities.

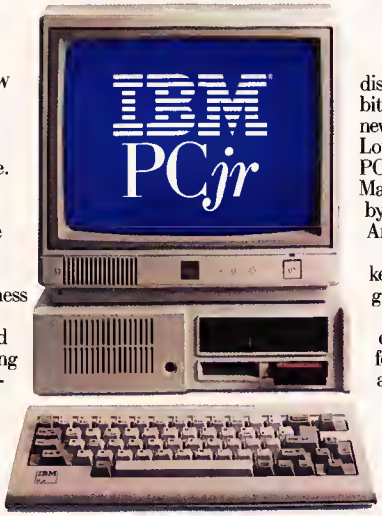
The secret weapon of MSX is its answer to the dream of

For personal computers that
have been very, very good this year...

Picture a computer under $1000 that runs over 1000 of the best programs written for the IBM PC.



Now picture this.



There's a lot that's new about PC*jr* and it's all good news for you.

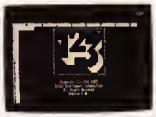
PC*jr* now has a lower price.

A new typewriter-style keyboard.

A new option that can give user memory a dramatic boost.

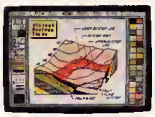
And new business and personal programs to add to its fast-growing library of up-to-date programs.

All of which can make PC*jr* the most useful computer a little money can buy.



Right now, PC*jr* can run the powerful Lotus 1-2-3™ on diskette (with Lotus 1-2-3 PC*jr* Installation Kit and additional memory). The new cartridge version, requiring no additional memory, will be available this fall.

Managing Your Money™ by Andrew Tobias, new on cartridge for PC*jr*, is a comprehensive personal financial advisor and manager.



Turn your screen into a canvas. The new cartridge program, PC*jr* ColorPaint, lets you create with the added dimension of color.

It comes standard with 128KB of user memory—twice the memory of its most popular competitor. An advanced 16-bit processor. And a double-sided diskette drive that can store over twice as much information as most single-sided drives.

With all these features, PC*jr* can run over a thousand of the most popular programs written for the IBM PC. And with the new optional 128KB Memory Expansion Attachment, it can run over a thousand more.

PC*jr* also runs a growing number of powerful cartridge programs. They work faster than diskettes, and don't take up a bit of user memory. The three newest examples being Lotus 1-2-3,™ the fascinating PC*jr* ColorPaint and Managing Your Money™ by financial expert Andrew Tobias.

As its library of software keeps growing, PC*jr* keeps growing, too. By leaps and bounds. Because IBM designed it with 13 ports for add-on options. And a modular construction that will accept new capabilities down the road. Even those that haven't been invented yet.

All this in a computer that weighs a mere 10 pounds.*

The new PC*jr* Memory Expansion Attachment can give memory a quick lift to 256KB. Or, along with a PC*jr* Power Expansion Attachment, all the way to a hefty 512KB.

Takes up just a bit over a square foot of desk space. And costs less than $1,000†, without monitor.

Picture yourself with a PC*jr*. Try one out and see what's new at an authorized IBM PC*jr* dealer or IBM Product Center.

For the name of the store nearest you, call 1-800-IBM-PCJR. In Alaska and Hawaii, call 1-800-447-0890.

More computer for your money.

See how PC*jr* compares with other computers at its price.

Memory
User Memory (RAM): 128KB (expandable to 512KB)
Permanent Memory (ROM): 64KB

Diskette Drive
Double-sided, double density
Capacity: 360KB

Processor
16-bit 8088

Keyboard
Typewriter-style
Detached; cordless

Warranty
1-year limited warranty

Software
Runs over 1,000 programs written for the IBM PC
Runs both diskette and cartridge programs

Display
40- and 80-column
Resolution:
4-color:
640h x 200v
16-color:
320h x 200v

Expandability
Open architecture
Optional 128KB Memory Expansion Attachment(s)
13 ports for add-ons, including built-in serial interface

PC*jr*'s new typewriter-style keyboard adds a nice touch to business, home or educational computing.

IBM PC*jr*

Growing by leaps and bounds.

Managing Your Money is a trademark of MECA.
1-2-3 and Lotus are trademarks of Lotus Development Corporation.

*Weight does not include power pack and monitor.
†IBM Product Center price.

Little Tramp character licensed by Bubbles Inc., s a.

practically everyone who has tried to piece together a computer system with today's hardware and software. MSX is a true standard—a coordinated system of hardware and software that is fully compatible across the product lines of competing manufacturers. The beauty of MSX is that any software program on tape, disk, or cartridge which runs on one MSX machine will run on any other. You can plug a Sony MSX program cartridge into a Yamaha or Panasonic MSX computer and it works exactly the same. Or pop a Sanyo MSX tape or disk into a JVC or Hitachi MSX computer. No emulators, no adapters, no confusion.

MSX peripherals are compatible, too. Disk drives, tape drives, printers, modems, joysticks, light pens—any accessory which adheres to the sharply defined MSX standard can be hooked up to any MSX computer. While American consumers and software publishers have had to wrestle with the mutually incompatible systems of Apple, Commodore, Atari, IBM, TRS-80, and others, MSX introduces a common, unified system.

What's more, MSX even offers some compatibility with popular de facto standards. The disk operating system, MSX-DOS, was written by the author of MS-DOS and is format-compatible with MS-DOS. That means an MSX computer can read disks formatted on an IBM PC or PC-compatible. MSX-DOS works almost exactly like MS-DOS, too. MSX-DOS also can run most programs written for the CP/M-80 operating system (opening up a library of thousands of programs, mostly business-oriented). And MSX BASIC is a very powerful and complete language which closely resembles IBM PCjr Cartridge BASIC and TRS-80 Color Computer Extended BASIC.

Most important, MSX isn't just a prototype or an untested product. The first generation of MSX computers made their debut in Japan in November 1983, and by midsummer 1984 more than 265,000 units had been sold, capturing a significant share of Japan's low-end home computer market. Now MSX is moving into Europe. The U.S. market, potentially the most lucrative, is next.

One of the main criticisms of MSX is that it's technologically obsolete compared to the newer 16- and 32-bit personal computers.

On the surface, the MSX concept might appear quite simple. Yet there are interesting paradoxes. First, although Japanese manufacturers are the strongest proponents of MSX, it's not owned by a Japanese company. It was developed by an American company, Microsoft Corporation (MSX stands for *Microsoft Extended*). The prime force behind MSX development was Kazuhiko "Kaye" Nishi, president of Microsoft's Far East Division. Nishi also cofounded the giant Japanese software and magazine publishing company ASCII-Microsoft, and designed the popular TRS-80 Model 100 portable computer.

Microsoft owns the rights to MSX and licenses the technology to the manufacturers. Since Microsoft announced MSX in Japan in June 1983, it has sold licenses to 16 Japanese and Korean consumer electronics firms, one European electronics giant (Philips), and a U.S. computer company with factories in Hong Kong (SpectraVideo).

Microsoft, of course, is virtually a household name—if your household has a personal computer. It was founded in the mid-1970s by two young college students, Bill Gates and Paul Allen, who wrote the first commercial BASIC interpreter for a microcomputer (the Altair). Since then, Microsoft BASIC has become the standard built-in language on nearly all personal computers, including Commodore, IBM, Apple, TRS-80, and numerous others. Microsoft is also the company behind MS-DOS, the most popular operating system for 16-bit personal computers.

But the fact that Microsoft has always been at the cutting edge of a very fast-moving marketplace raises another paradox: It has based MSX on the Zilog Z80A microprocessor (an 8-bit central processing unit), the Texas Instruments 9918A video chip (16 colors, 32 programmable sprites), the General Instruments programmable sound generator (three channels, eight octaves), 32K of ROM, and 16K to 64K of internal RAM. The technology is solid, versatile, cheap—and old. In fact, one of the main criticisms of MSX is that it's technologically obsolete compared to the newer 16- and 32-bit personal computers starting to appear.

Ironically, however, the low-end MSX computers (which will probably sell for around $200 or less) can be hooked up to everything from digital televisions and sophisticated light pens to powerful music synthesizers, laserdisc players, and a variety of other high-tech peripherals. If what really counts in a computer is not the

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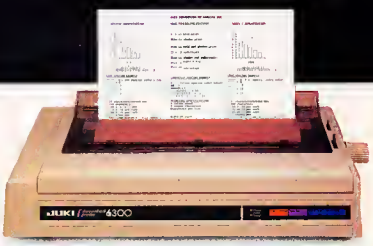

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The GoldStar FC-200 MSX Personal Computer, a Korean creation. The keyboard layout is very similar on all MSX computers. Notice the editing keys, cursor keypad, and preprogrammed special function keys. The hatch at the upper right conceals the ROM cartridge slot. The hole next to it is a light pen holder.

technology inside it, but the applications you can squeeze out of it, then the MSX machines may actually seem *more* advanced than today's home computers—especially to consumers who won't know an 8-bit chip from a Frito.

Experience in the marketplace lends credence to this theory. For instance, although Apple II-series computers have changed relatively little since 1977 and are as technologically obsolete as MSX computers, the vast selection of quality software and expansion hardware helps to keep the Apple IIe and IIc very popular, even at high-end prices. It's apparent that people perceive the value of a computer in the tasks it can perform, not the circuitry it's made of.

If this principle holds true for MSX machines, their old technology may not be a handicap. Who will worry about the 8-bit CPU if MSX home computers are the only ones on the market that can blend computer graphics and videodisc images on your TV screen for super-realistic videogames and educational programs? Who will care about the limited three-channel tone generator if the MSX computers are the only ones that can be easily and economically converted into state-of-the-art polyphonic music synthesizers? Technical-minded hobbyists might care, but the MSX companies aren't hunting for that market. They have a much bigger game in mind.

Dated though it may be, the MSX technology will be tied to modern marketing strategies which could radically change the way home computers are sold. You can expect that part of this strategy will be to avoid the tiresome bits-and-bytes sales pitches and confusing comparisons that chase people out of the store. All the big MSX backers are consumer electronics companies, not computer companies. They're accustomed to mass-marketing TV sets, stereos, and videocassette recorders, and that's the way they'll try to sell MSX home computers.

Consider the sheer marketing strength of 18 companies selling what is essentially the same computer simultaneously. Industry observers were impressed earlier this year when IBM budgeted an estimated $40 million for an advertising campaign to launch the PCjr. IBM is one of the few companies that could afford such a sum. Apple budgeted $20 million to introduce the IIc, and even more for the Macintosh. Yet if the 18 MSX companies averaged, say, $5 million each for advertising and promotion, it would have the same impact as a competitor's $90 million campaign. If they each chipped in $10 million, it would be a $180 million campaign. When you figure in the MSX advertising from independent software publishers and the likelihood of additional MSX licensees, you can see why MSX is a marketing force to be reckoned with.

"The success of MSX really boils down to the number of companies that can, during a relatively short period of time, make their product introductions into the U.S.," says Ron Hisogi, manager of Far East business development for Microsoft. "In other words, having two companies selling MSX computers in the U.S. will not be as effective as if ten companies come here and say, 'We are here with these MSX machines. This is what our respective products do.' That would carry a lot more weight. Critical mass is really a key to making sure MSX takes off."

Most, but not necessarily all, of the 18 MSX companies will probably market MSX computers in the U.S. next year. Microsoft would like to see them enter the U.S. market soon, and indications are that it will most likely happen at the January 1985 Consumer Electronics Show (CES) in Las Vegas. At last June's CES in Chicago, MSX machines were

Introducing

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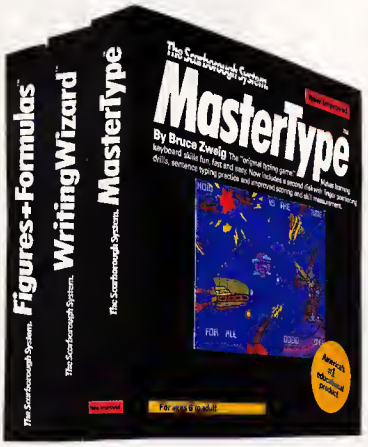
and the newest members of the MasterType Family.



America's #1 educational software program now has the elements of a traditional touch-typing course in addition to being the most entertaining way ever to learn to type. New Improved MasterType now includes a second diskette of finger positioning drills and games to increase your typing speed and accuracy.

You'll become an expert typist faster than ever as you master the keyboard. Then you'll be ready to try two new programs in the MasterType Family.

MasterType's Writing Wizard.™ The easiest, friendliest full-function word processing program you'll ever find. And Writing Wizard will help you write effectively too. Color highlighting for easy editing, dual windows, a handy database with mail merge capability and multiple typefaces make it easy for you and your children to express yourselves clearly and creatively.

MasterType's Figures & Formulas.™ The "computing encyclopedia" of weights and measures for kids and adults. From centimeters to light years, you can calculate, convert and compare. Figures & Formulas will even allow you to create customized quizzes for your kids.

The MasterType Family of programs makes learning more fun and easier than ever for both you and your children. Look for these programs at your dealer's now.

Availability:

New Improved MasterType:	Apple IIe/IIc,® IBM– PC/XT/PCjr,® Atari,® Commodore 64.® All with 2 disks, only 1 disk drive necessary. Macintosh disk. Atari and Commodore cartridges.
MasterType's Writing Wizard:	Apple IIe (128k)/IIc, Commodore 64. Both with 2 disks, only 1 disk drive necessary.
MasterType's Figures & Formulas:	Apple IIe/IIc, Commodore 64.

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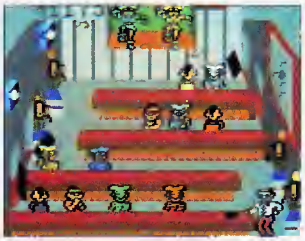
OUR ARCADE GAMES WE BROUGHT

Bally Midway's Spy Hunter puts you in the driver's seat of the hottest machine on four wheels. You're after enemy spies. The situation is life and death. You'll need every weapon you've got – machine guns, and guided missiles, oil slicks and smoke screens. But the enemy is everywhere. On the road, in the water, even in the air. So you'll have to be more than fast to stay alive in Spy Hunter. You'll need brains and guts, too.

Do you have what it takes?



Bally Midway's Tapper would like to welcome you to the fastest game in the universe.

You're serving up drinks in some of the craziest places you've ever seen. And the service better be good, or else. You'll work your way through the wild Western Saloon to the Sports Bar. From there to the slam dancing Punk Bar and on into the Space Bar full of customers who are, literally, out of this world.!

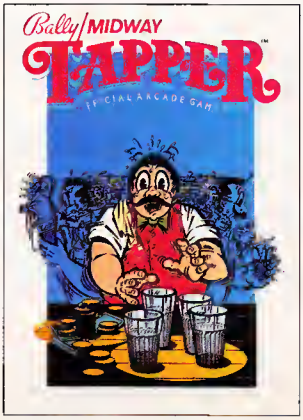
Are you fast enough to play Tapper? If you have to ask, you probably already know the answer.

Bally Midway's Up 'N Down by Sega. In this game, a crash is no accident.

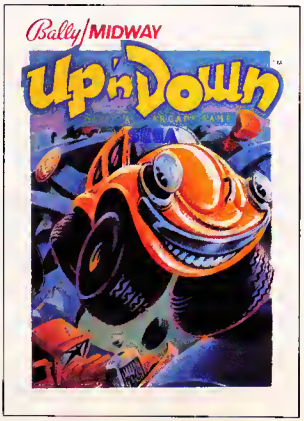
In fact, it's the whole object of the game. You'll race your baja bug over some of the worst roads south of any border. Leap dead ends, gaping canyons and oncoming traffic in a single bound. And if anyone gets in your way, crush 'em.

Crashing, bashing Up 'N Down. It's one smash hit that really is a smash.

The #1 Arcade Game of 1984.



Nominated as Most Innovative Coin-Op Game of 1984 by *Electronic Games* magazine.



#1 Arcade Hit, *Play Meter* Conversions Poll, 8/1/84.

WERE SUCH BIG HITS, THEM HOME.

Sega's Congo Bongo rocked the home game world when it shot up to Number 3 on the Billboard chart this spring.

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	SPY HUNTER	TAPPER	UP 'N DOWN	CONGO BONGO	ZAXXON
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Atari 5200 cartridge				✓	✓ NEW
Atari Computers* cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Atari Computers† diskette	✓ NEW	✓ NEW	✓ NEW		✓
ColecoVision & ADAM cartridge	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Commodore 64 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Commodore 64 diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Apple II, IIe, IIc diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
IBM PC diskette	✓ NEW	✓** NEW	✓ NEW	✓** NEW	✓** NEW

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*Atari 400, 800, 600XL, 800XL and 1200XL. (Congo Bongo cartridge: 400, 800 and 800XL.)
†Atari 800, 600XL, 800XL and 1200XL.
**Also available for IBM PCjr.

All new games are scheduled to be in your stores for Christmas. Check your local dealer.

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Arcade and Home Smash. Hit #3 on *Billboard* magazine's Top Video Games survey.

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already on display at booths run by three Korean manufacturers—Daewoo, GoldStar, and Samsung—and a Japanese company, JVC. One evening during CES, Microsoft held a private showing of Japanese MSX machines for selected third-party developers at Chicago's chic Javon Restaurant. The party, hosted by Microsoft's Bill Gates, also was intended to lure more manufacturers into the fold.

To date, the MSX licensees include the three Korean companies mentioned above, Philips (The Netherlands), Spectra-Video, and the following Japanese consumer electronics firms: Canon, Fujitsu, General, Hitachi, Kyocera, Mitsubishi, Matsushita (also known as National or Panasonic), Pioneer, Sanyo, Sony, Toshiba, Victor (JVC), and Yamaha.

Do most of those names sound familiar? They should. They practically dominate the U.S. market for TV sets, audio equipment, videodisc players, videocassette recorders, and other consumer products. And the companies themselves are banking on that name recognition, too.

Some critics spot a potential flaw in the ambitious MSX marketing strategy. What if the unified approach and attempt to establish a true standard backfires? How can so many manufacturers compete by selling the same computer?

The MSX companies have a response: the same way they compete by selling TV sets, stereos, VCRs, cameras, and other virtually identical consumer products. Each computer will be slightly differentiated by extra features or enhancements which are related to the company's particular strengths in the consumer electronics field.

Yamaha, for example, will offer an optional plug-in music synthesizer and piano-style keyboard which converts its MSX YIS503 computer into the equivalent of a sophisticated Yamaha DX7 polyphonic music synthesizer. The computer becomes a real musical instrument which puts even the Commodore 64 SID chip to shame. And if you can't play a note, don't worry; an optional bar code reader lets you feed popular tunes into the synthesizer for playback. Then you can modify the music almost any way you want, changing the beat, tempo, pitch, or instrumentation. If you want to play along, you can do that too—a keyboard display on the screen even shows beginners which note to play next.

The General Corporation, a Japanese firm known for its high-quality TV sets, has another angle. It manufactures a TV with a built-in MSX computer. "You plug a detachable keyboard into it and it turns into an MSX machine," explains Microsoft's Hisogi. "The nice thing is that the cartridge slot, the printer port, and all of that are integral parts of the TV set itself." The 14-inch TV, selling in Japan for the equivalent of about $550, houses the tuner and MSX system behind a three-inch panel below the screen.

Sanyo might emphasize its high-quality light pen system with the MPC-10 32K computer. Sony's HitBit 64K machine has built-in productivity software. Pioneer's Palcom PX-7 contains a video interface which mixes computer graphics and laserdisc images on the same screen. And the list goes on.

"Victor has an MSX machine [the 32K HC-6] that has an RGB transposing unit," says Hisogi. "You can actually take images created from a personal computer and superimpose them on an RGB monitor in conjunction with a videodisc player. It also has the capability to be used for a monitoring station to control your audio and video equipment."

In a recent demonstration at COMPUTE!, the Pioneer PX-7 MSX computer was interfaced with a laserdisc player. Using a joystick, you controlled a computer-generated space fighter (a sprite) while zooming through stunning scenes stored on the laserdisc. You could shoot at enemy spacecraft and maneuver through harrowing canyons on alien planets. It was like leaping into *Star Wars*. The images were every bit as good as those in the latest videodisc arcade games.

The PX-7, by the way, revealed something else about

This screen photo from Step Up, *a cartridge-based arcade game from GoldStar, shows an example of MSX graphics (the blurred images are fast-moving sprites which could not be frozen by the camera).*

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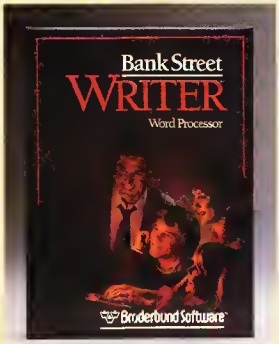

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MSX marketing strategy—it didn't resemble a traditional home computer at all. Rack-styled to match Pioneer's audio and video components, it looked more like a front-loading VCR or stereo receiver. To use it as a computer, you plug in a detachable keyboard on an extension cord.

Despite all the development work and market planning that has been invested in MSX, its success is hardly guaranteed. The U.S. home computer market is as volatile as it is lucrative; as many fortunes have been lost as won. In mid-1983, the sky seemed the limit. By mid-1984, the adolescent-like growth started leveling off as the industry matured. Experienced companies such as Texas Instruments and Mattel have been knocked out of the fight completely. Coleco is fighting an uphill battle. Atari, which had everything going for it two years ago, is severely weakened. Even mighty IBM, which seemed a shoo-in last year, stumbled embarrassingly in the home market with its PCjr. Is MSX a year too late? Why has introduction into the U.S. been delayed until 1985?

"All of them [the Japanese companies] had one thing in mind, and that was to cultivate their own domestic marketplace—that's Japan," explains Hisogi. "The second reason, I believe, is because it's true that about the time MSX was introduced in Japan, the home computer market was going through a major shakeup, at least for the United States. I believe many Japanese manufacturers said, 'Well, let's wait and see until the dust settles.' "

As the U.S. marketplace continues to race along on its own course—with 64K home computers beginning to give way to 128K machines, and 8-bit chips to 16- and 32-bit CPUs—many industry observers still contend that memory limitations and dated technology will doom the new MSX computers before they even arrive. Hisogi disagrees: "I don't think the manufacturers that are bringing MSX machines into the U.S. will even try to market 16K or 32K computers. They already have 64K machines . . . and adding RAM is not a big deal. I would suspect that they will study the competitive environment here and determine that no one practically sells any 32K or 16K machines. And I believe they will try to match their configurations to the point where they can effectively compete."

Next month, Part 2 takes you inside MSX and reveals some of the technical features which make it a versatile, workable standard. We'll also analyze the performance of a typical MSX computer. ©

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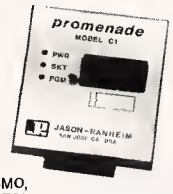

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Things In The Dark

Scott Baker

Can you wrest control of the Dark World from the norfs by capturing snakes, dinits, blockheads, and pink graps? "Things In The Dark" is populated by a myriad of strange creatures and is paced for youngsters. Originally written for the Atari (16K RAM with tape, 32K RAM for disk), we've added versions for the Commodore 64; unexpanded VIC-20; Apple (at least 48K RAM); TI-99/4A; IBM PC (at least 64K RAM and color/graphics adapter); and PCjr. The Atari and Commodore versions require a joystick.

You are in a strange Dark World populated by bizarre creatures. Your job is to keep this world free of gremlins, dinits, blockheads, snakes, and pink graps. To accomplish this, you move your robot over these creatures. If you score 2500 points you are rewarded with another robot (except in the TI version).

Your adversaries in the Dark World are the terrible *norfs*, who can appear anywhere on the screen. They won't attack you directly, but if you bump into one, your robot and the norf will be zapped out of existence. As more and more norfs fill the screen, it becomes increasingly difficult to maneuver. Eventually, you may have to sacrifice a robot to escape from a ring of evil norfs, creatures whose rapacity cannot be overemphasized.

Avoiding Turncoat Graps

All versions of "Things In The Dark" have their own instruction screens explaining the particular details of each program. But they share the same basic features. Each version has six levels of difficulty. The game automatically advances to higher levels at 5000-point intervals unless you select the No Advance option (which allows you to play the entire game at the same level). The robot in play always appears first at the center of the screen. A spare robot appears in the upper-right corner of the screen, ready to jump into action should your current robot be done in by a norf.

Your score is recorded in the upper-left corner of the screen. Above the score is the grap count, which tells you how much time is left before a grap changes color. This is important because you gain points by running over a normal-colored grap, but you'll be destroyed by touching one that has changed color. (Grap colors vary in the different programs; also, the grap turns upside-down instead of changing colors in the Apple version.) The game's present level of difficulty is also displayed on the screen, along with the number of turns you have left. If the turn counter reaches zero, the game ends.

In the IBM, TI, and Apple versions, your robot moves continuously. Use the cursor keys to control direction in the IBM and TI versions; use I-J-K-L in the Apple version.

You can temporarily freeze the action on the Atari, Commodore 64, and VIC-20 versions by pressing the joystick button. Continue the game by pressing the button again. On the TI version, freeze by pressing P (for Pause) and continue by pressing R (for Restart). On the IBM version, freeze by pressing Ctrl-Num Lock on the PC or Function-Q (Pause) on the PCjr; continue by pressing a cursor key. On the Apple version, freeze by pressing CTRL-S; continue by pressing CTRL-S again.

To fit Things In The Dark into an unexpanded VIC-20, the VIC version is broken into two programs. Program 3 is the loader and Program 4 is the main program. Type in and save both programs before attempting to run the game. Save Program 4 with the filename V5. (If you're using cassette, be sure to save Program 4 immediately after Program 3 on the tape, and

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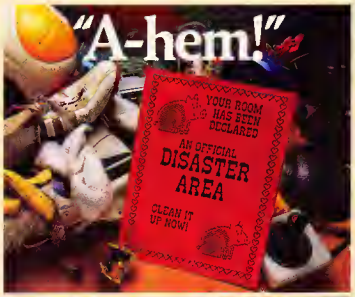

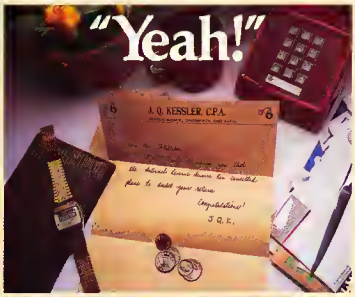

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change the 8 to a 1 in line 400 of Program 3.) Finally, run Program 3. It displays the instruction screens and automatically loads the main program from disk or tape.

Atari Version Notes

When you run Things In The Dark, the screen will blank out for 13 seconds as the program initializes. Afterward you'll see the first of three instruction screens. Press SELECT to advance to the next screen or to return to the first screen from the final screen.

Type in the level you want when the menu appears on the third instruction screen. You can also press the OPTION button to choose the No Advance option. To begin the game, press START.

On the higher levels, you have fewer turns in which to score (only ten turns in level six). Also, turns will go by rapidly, fewer creatures will be plotted, and graps will stay pink for a shorter period of time.

Toward the end of the game, it's wise to open important channels by sacrificing a robot against a norf. After all, there's no point in having extra robots if the turn counter runs out. Remember that the robot can wrap around to the other side of the screen. You can safely pass over dinits, although no points will be earned. In addition, a norf will never appear on a space occupied by a dinit.

Smart Snakes And Other Secrets

After playing Things In The Dark for a while, you may notice that the snakes never land on any green or orange creatures. Basically, the series of LOCATE statements in the snake subroutine (lines 350–434) tell the snake to check first for a space free of orange or green creatures in front of itself.

The variable D determines whether to go to the LOCATE routine from lines 380–389 or to the routine from lines 390–399. These routines move the snake right and left, respectively.

If there is a clear space in front of the snake, it moves to that space and the program returns to the main loop. If the space is occupied, the spaces below the snake and then above it are checked for a clear space. If both these spaces are occupied, the snake is stuck. The snake never reverses direction except when it reaches the left or right side of the screen.

Similar logic moves the grap, except that it avoids orange creatures and moves diagonally. DATA statement 2600 decides whether to pass control to line 560, 580, 600, or 620, where routines locate the first space to the lower right, lower left, upper left, and upper right, respectively. Also, unlike the snake, the grap only tries to move once before control returns to the main loop.

Both the snake and the grap display a simple sort of simulated intelligence, and the logic behind them may be worth using in other games.

Atari Version Variable Listing

SNK	Number to score before a new snake appears.
SNKCT	Flag set to one to prevent more than one snake from being onscreen at the same time.
E	Column position of the leftmost bonus robot.
XRBT	Number to score to earn a bonus robot.
TRNCT	Maximum number of turns left in which you must score to prevent the game from ending.
MN	Flag set to one when a string of dinits is plotted, preventing green things and norfs from being plotted.
INCRLVL	Automatically advances game to next level of difficulty when INCRLVL is less than SCORE and OP equals zero.
OP	Prevents levels from advancing when set to one.
EDCT	Controls number of times through inner main loop before a norf, dinit, or green thing is plotted. Set equal to LVL when grap first appears.
LVL	Maximum number of turns in which you must score for a given level of difficulty.
LEVEL	Level of difficulty.
D	Determines the direction the snake will travel.
ND	Determines the direction to plot a string of dinits.
COL, ROW	Horizontal and vertical position of robot.
SNKC, SNKR	Horizontal and vertical position of snake.
GRPC, GRPR	Horizontal and vertical position of grap.

Program 1: Things In The Dark For Atari

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
DA 5 GOTO 2000
PH 10 GRAPHICS 17:POKE 756,B:POKE 71
   0,152:POKE 708,38
CH 20 COL=9:ROW=11:COLOR 162:PLOT CO
   L,ROW:SOUND 0,190,10,10
MA 50 SCORE=0:SNK=1000:SNKCT=0:E=20:
   XRBT=2500:TRNCT=LVL:MN=0:INCRL
   VL=5000
IJ 60 SOUND 0,0,0,0:GOSUB 723
JA 70 POSITION 0,1:? #6;"■ 0
   {5 SPACES}■ ";LEVEL;:? #6;" ■
   ■ ";TRNCT
PO 80 POSITION 0,0:? #6;"■■■"
AN 99 REM 100-190 MAIN LOOP
CL 100 EDCT=5:GOTO 500
NM 120 FOR CT=EDCT TO 1 STEP -1
AD 125 IF EDCT>5 THEN GOSUB 550
KE 130 W=0:GOSUB 200
JH 135 IF STRIG(0)=0 THEN 2700
EC 140 IF TRNCT=9 THEN COLOR 0:PLOT
   18,1
AO 145 POSITION 17,1:? #6;TRNCT:TRNC
```

SCRABBLE®
THE COMPUTER VERSION.
IT'S YOU AGAINST YOUR COMPUTER.

Now, through the magic of your computer you can play SCRABBLE® even when you don't have a human opponent handy. SCRABBLE,® the computer version, pits you (and up to two other players) against the computer in the most popular word game of all time. The computer program provides you and your computer-controlled opponent with seven letters, and the contest is on. The program displays the board status, tracks the score, and deals out new letters. You and your computer-controlled opponent try to maximize your score on each word. There are four different levels of difficulty and, of course, there are double and triple letter and word scores. There's even a "hint" option when you're having problems. Now, you 100 million SCRABBLE® players have a new challenge: Are you good enough to beat your computer?

One to three players. Keyboard-controlled disc or cassette.

Marketed and Distributed by

EPYX™ COMPUTER SOFTWARE

Manufactured under license from Milton Bradley Corporation, owner of the registered trademark MONTY® and Selchow & Righter Company owner of the registered trademark SCRABBLE® and of the copyrighted rules of instruction and board design

Evading norfs in "Things In The Dark," Atari version.

```
      T=TRNCT-1:IF TRNCT=-1 THEN 90
      Ø
LE 15Ø IF EDCT=5 AND SCORE>=SNK THEN
       GOSUB 35Ø
BE 16Ø NEXT CT:IF EDCT>5 THEN GOSUB
      75Ø
AD 168 IF MN=1 THEN 445
NH 17Ø V=INT(2Ø*RND(1)):H=INT(22*RND
      (1))+2:LOCATE V,H,P
NF 18Ø IF P=162 OR P>133 AND P<137 T
      HEN 17Ø
KG 183 IF P=35 OR P=17Ø THEN 1ØØ
JM 185 R=INT((1Ø*LEVEL)*RND(1)):IF R
      =Ø THEN 44Ø
MJ 19Ø COLOR 35:PLOT V,H:GOTO 1ØØ
EE 199 REM MOVE ROBOT
MP 2ØØ ST=STICK(Ø):IF W=LVL THEN RET
      URN
CO 21Ø IF ST=14 THEN 22Ø
CO 211 IF ST=11 THEN 24Ø
DD 212 IF ST=13 THEN 26Ø
AJ 213 IF ST=7 THEN 28Ø
QE 215 W=W+1:GOTO 2ØØ
LO 22Ø COLOR Ø:PLOT COL,ROW
FJ 225 IF ROW=2 THEN ROW=24
GN 23Ø ROW=ROW-1:GOSUB 3ØØ
HK 235 RETURN
MA 24Ø COLOR Ø:PLOT COL,ROW
CB 245 IF COL=Ø THEN COL=2Ø
DL 25Ø COL=COL-1:GOSUB 3ØØ
HM 255 RETURN
MC 26Ø COLOR Ø:PLOT COL,ROW
FL 265 IF ROW=23 THEN ROW=1
GP 27Ø ROW=ROW+1:GOSUB 3ØØ
HQ 275 RETURN
ME 28Ø COLOR Ø:PLOT COL,ROW
FL 285 IF COL=19 THEN COL=-1
DN 29Ø COL=COL+1:GOSUB 3ØØ
IA 295 RETURN
AB 299 REM CHECK NEW ROBOT POS.,PLOT
       ROBOT & UP SCORE OR KILL ROB
      OT
CM 3ØØ SOUND Ø,19Ø,1Ø,1Ø
NC 3Ø2 LOCATE COL,ROW,P:SOUND Ø,Ø,Ø,
      Ø
HL 3Ø4 IF P=35 OR P=41 THEN 95Ø
PO 3Ø6 IF P=4 THEN SCORE=SCORE+1ØØ:G
      OSUB 7ØØ:GOTO 33Ø:REM BLOCKHE
      AD
GC 3Ø8 IF P=5 THEN SCORE=SCORE+1Ø:GO
      SUB 7ØØ:GOTO 33Ø:REM GREMLIN
IG 31Ø IF P=134 OR P=135 THEN SCORE=
      SCORE+2ØØ:SNK=SNK+1ØØØ:SNKCT=
      Ø:GOSUB 7ØØ:GOTO 67Ø:REM SNAK
      E
CK 32Ø IF P=136 THEN SCORE=SCORE+4ØØ
      :EDCT=5:GOSUB 7ØØ:GOSUB 76Ø:R
      EM GRAP
ED 33Ø COLOR 162:PLOT COL,ROW:RETURN

AG 349 REM SNAKE SUBROUTINE
OG 35Ø IF SNKCT=1 THEN 375
BJ 352 SNKC=INT(2*RND(1)):SNKR=5:SNK
      CT=1
LJ 354 IF SNKC=1 THEN SNKC=19:D=1
KJ 356 IF SNKC=Ø THEN D=Ø
GG 36Ø LOCATE SNKC,SNKR,P
EB 362 IF P=4 OR P=5 OR P=35 OR P=16
      2 OR P=41 AND SNKR<24 THEN SN
      KR=SNKR+1:GOTO 36Ø
EH 365 IF SNKR=24 THEN SNKCT=Ø:RETUR
      N
JG 37Ø IF D=Ø THEN COLOR 134:GOSUB 4
      95:RETURN
JK 372 IF D=1 THEN COLOR 135:GOSUB 4
      95:RETURN
KL 375 IF D=1 THEN 39Ø
ME 38Ø LOCATE SNKC+1,SNKR,P
CC 382 IF P=162 THEN 485
DN 383 IF P=4 OR P=5 OR P=35 OR P=41
       THEN 4ØØ
KL 385 COLOR Ø:GOSUB 495
EG 387 SNKC=SNKC+1:COLOR 134:GOSUB 4
      95
PA 388 IF SNKC=19 THEN D=1:GOTO 4ØØ
IE 389 RETURN
MH 39Ø LOCATE SNKC-1,SNKR,P
CD 392 IF P=162 THEN 485
DO 393 IF P=4 OR P=5 OR P=35 OR P=41
       THEN 4ØØ
KM 395 COLOR Ø:GOSUB 495
EK 397 SNKC=SNKC-1:COLOR 135:GOSUB 4
      95
LG 398 IF SNKC=Ø THEN D=Ø:GOTO 4ØØ
IF 399 RETURN
NG 4ØØ IF SNKR=23 THEN 488
LP 4Ø2 LOCATE SNKC,SNKR+1,P
BN 4Ø4 IF P=162 THEN 485
DL 4Ø6 IF P=4 OR P=5 OR P=35 OR P=41
       THEN 42Ø
KH 4Ø8 COLOR Ø:GOSUB 495
GM 41Ø SNKR=SNKR+1:IF D=1 THEN COLOR
       135
BN 412 IF D=Ø THEN COLOR 134
NF 414 GOSUB 495:RETURN
KF 42Ø IF SNKR=2 THEN 488
MD 422 LOCATE SNKC,SNKR-1,P
BP 424 IF P=162 THEN 485
IH 426 IF P=4 OR P=5 OR P=35 OR P=41
       THEN RETURN
KJ 428 COLOR Ø:GOSUB 495
HA 43Ø SNKR=SNKR-1:IF D=1 THEN COLOR
       135
BP 432 IF D=Ø THEN COLOR 134
NH 434 GOSUB 495:RETURN
HA 439 REM 44Ø-483 DINIT SUBROUTINE
CG 44Ø MN=1:COLOR 17Ø:PLOT V,H:IF V<
      11 THEN ND=Ø:GOTO 12Ø
```

INTRODUCING COMPUTER ACTIVITY TOYS™...

...BECAUSE BUILDING YOUR CHILD'S IMAGINATION IS NOT A GAME.

We all know that you can't kid a kid. And younger kids are growing tired of arcade-type computer games that don't hold their interest, while learning programs frequently don't generate any interest at all.

Now, EPYX introduces *Computer Activity Toys*, featuring Barbie,™ Hot Wheels™ and G.I. Joe.® The perfect way for children ages 4–10 to engage in imaginative, non-structured, non-competitive play patterns either individually or with a friend.

Now on your computer screen, your little girl can dress a Barbie™ Doll and change her clothes and her hair styles. Your boy can move a Hot Wheels car around a Hot Wheels™ garage, after actually designing the car on the computer screen. He can engage in a make-believe battlefield scenario with G.I. Joe® pitted against Cobra.™

The hours of time tested, imaginative free play generated by these well-known toys and dolls can now have added dimensions of control, versatility and realism through the magic of the home computer. They are disc-based products so you can be sure there are enough activities to keep your child occupied and entertained hour after hour.

EPYX COMPUTER SOFTWARE

Computer Activity Toys...

Because building a child's imagination is not a game.

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```
KA 442 ND=1:GOTO 120
PE 445 IF ND=0 THEN 460
IM 448 IF V-1<0 THEN MN=0:GOTO 120
PF 450 LOCATE V-1,H,P
AM 453 IF P>133 AND P<137 THEN 120
PB 455 V=V-1:GOTO 482
MA 460 IF V+1>19 THEN MN=0:GOTO 120
PH 463 LOCATE V+1,H,P
AP 465 IF P>133 AND P<137 THEN 120
OA 470 V=V+1
HN 482 IF P=35 OR P=41 OR P=162 OR P
       =170 THEN MN=0:GOTO 100
PN 483 COLOR 170:PLOT V,H:GOTO 100
OE 485 SCORE=SCORE+200:GOSUB 700
GF 488 COLOR 0:PLOT SNKC,SNKR
NI 490 SNK=SNK+1000:SNKCT=0:GOTO 670
EJ 495 SOUND 0,130,10,12:PLOT SNKC,S
       NKR
IM 498 SOUND 0,0,0,0:RETURN
GB 499 REM GREMLIN & BLOCKHEAD ROUTI
       NE
LD 500 GOSUB 545
PL 504 IF P=35 OR P=170 OR P=162 OR
       P=134 OR P=135 THEN 500
LK 510 SOUND 0,100,10,11:COLOR 5:PLO
       T V1,H1
FJ 520 J=INT((LEVEL+1)*RND(1)):SOUND
        0,0,0,0:IF J>0 THEN 120
LI 523 GOSUB 545
PO 527 IF P=35 OR P=170 OR P=162 OR
       P=134 OR P=135 THEN 120
GC 530 SOUND 0,193,10,12:COLOR 4:PLO
       T V1,H1:FOR W=0 TO 5:NEXT W:S
       OUND 0,0,0,0:GOTO 120
AN 545 V1=INT(20*RND(1)):H1=INT(22*R
       ND(1))+2
BL 548 LOCATE V1,H1,P:RETURN
MA 549 REM GRAP SUBROUTINE
PP 550 POSITION 4,0:? #6;CT:W=0:IF C
       T=9 THEN COLOR 0:PLOT 5,0
HP 555 READ I:IF I=99 THEN RESTORE 2
       600:READ I
CD 557 GOTO I
IK 560 IF GRPR=23 OR GRPC=19 THEN RE
       TURN
BN 563 LOCATE GRPC+1,GRPR+1,P
MF 564 IF P=35 OR P=41 THEN RETURN
LM 565 GOSUB 660
FO 568 COLOR 0:PLOT GRPC,GRPR
ON 570 GRPR=GRPR+1:GRPC=GRPC+1:GOTO
       695
FC 580 IF GRPR=23 OR GRPC=0 THEN RET
       URN
CB 583 LOCATE GRPC-1,GRPR+1,P
MH 584 IF P=35 OR P=41 THEN RETURN
LO 585 GOSUB 660
GA 588 COLOR 0:PLOT GRPC,GRPR
PB 590 GRPR=GRPR+1:GRPC=GRPC-1:GOTO
       695
BI 600 IF GRPR=2 OR GRPC=0 THEN RETU
       RN
BM 603 LOCATE GRPC-1,GRPR-1,P
MA 604 IF P=35 OR P=41 THEN RETURN
LH 605 GOSUB 660
FJ 608 COLOR 0:PLOT GRPC,GRPR
OM 610 GRPR=GRPR-1:GRPC=GRPC-1:GOTO
       695
FE 620 IF GRPR=2 OR GRPC=19 THEN RET
       URN
```

The robot is busy eliminating blockheads in this game of "Things In The Dark" on the Commodore 64.

```
BM 623 LOCATE GRPC+1,GRPR-1,P
MC 624 IF P=35 OR P=41 THEN RETURN
LJ 625 GOSUB 660
FL 628 COLOR 0:PLOT GRPC,GRPR
OM 630 GRPR=GRPR-1:GRPC=GRPC+1:GOTO
       695
OD 660 COLOR 0:PLOT GRPC,GRPR:IF P=1
       62 THEN SCORE=SCORE+400:EDCT=
       5:GOSUB 700:GOSUB 760:GOTO 12
       0
JB 665 RETURN
PN 670 GRPC=INT(20*RND(1)):GRPR=22:E
       DCT=LVL:CT=EDCT
CE 675 LOCATE GRPC,GRPR,P:IF P=162 T
       HEN 670
FH 680 COLOR 162:PLOT COL,ROW:RESTOR
       E 2600
KE 695 SOUND 3,INT(150*RND(1))+25,10
       ,10:SOUND 3,0,0,0
OG 698 COLOR 136:PLOT GRPC,GRPR:RETU
       RN
JI 699 REM SCORE & LEVEL ADVANCE
KH 700 SOUND 0,65,10,8:POSITION 3,1:
       ? #6;SCORE:SOUND 0,0,0,0
GO 701 IF OP=1 OR SCORE<INCRLVL THEN
        710
NO 703 IF LVL>10 THEN LEVEL=LEVEL+1:
       LVL=LVL-10:INCRLVL=INCRLVL+50
       00:POSITION 12,1:? #6;LEVEL
CE 704 FOR W=80 TO 0 STEP -W/10:SOUN
       D 0,W,10,10:POKE 712,2*W:FOR
       W1=0 TO W:NEXT W1
JJ 706 SOUND 0,0,0,0:POKE 712,0:NEXT
        W
CC 710 TRNCT=LVL:POSITION 17,1:? #6;
       TRNCT:IF SCORE>=XRBT THEN 720
HN 715 RETURN
LF 719 REM EARN EXTRA ROBOT
EI 720 XRBT=XRBT+2500
GL 723 SOUND 2,243,10,12:POKE 77,0
CM 725 E=E-1:IF E=6 THEN E=7
MM 730 COLOR 162:PLOT E,0
BF 740 FOR W=0 TO 9:NEXT W:SOUND 2,0
       ,0,0:RETURN
FI 750 EDCT=5:COLOR 41:PLOT GRPC,GRP
       R
EL 760 CT=0:POSITION 4,0:? #6;"  ":R
```

IMPOSSIBLE MISSION.™
YOUR MISSION–TO SAVE THE WORLD.

As a member of the exclusive Anti-Computer Terrorist Squad (ACT), your mission is to find and reach the infamous Elvin, who is holding the world's population hostage under threat of nuclear annihilation. You must negotiate a path through the rooms and tunnels of his headquarters trying to avoid Elvin's robot protectors.

Should you try to outrun or jump over the next robot or play it safe and take the time to assemble the codes needed to deactivate the robots and then to find and stop Elvin.

Use your camera to photograph as many clues as possible to find the password which will allow you to penetrate Elvin's control room.

Your Mission—To Save The World, But Hurry!

One player, joystick controlled.

EPYX™
COMPUTER SOFTWARE

Strategy Games for the Action-Game Player

```
      ETURN
AA 800 POKE 708,38:COLOR 0:PLOT E,0
GH 810 E=E+1:PLOT COL,ROW:COLOR 162:
      COL=9:ROW=11:PLOT COL,ROW:GOT
      O 100
JG 900 POSITION 0,10:? #6;"LEVEL ";L
      EVEL;" YOU FINISHED TO SCORE I
      N ";LVL;" TURNS":GOTO 1000
IC 950 SOUND 0,255,8,12:POKE 708,104
      :IF EDCT>5 THEN GOSUB 750
JM 960 FOR W=0 TO 50:NEXT W:SOUND 0,
      0,0,0:IF E<20 THEN 800
IH 1000 FOR W=1 TO 100 STEP 5:SOUND
      0,W,10,10:NEXT W:SOUND 0,0,0
      ,0:POSITION 6,4:? #6;" the G
      ame "
PK 1010 OPEN #2,4,0,"K:"
BL 1025 POSITION 1,16:? #6;"PRESS
      (33 SPACES)select  instructio
      nsstart(3 SPACES)begin game
       "
BJ 1030 IF OP=0 THEN POSITION 0,20:?
       #6;"option  advance
      (5 SPACES)level every 5000 p
      ts":GOTO 1045
PA 1040 POSITION 0,20:? #6;"option
      no advance  level every 5000
       pts"
FA 1045 POSITION 0,22:? #6;"
      (20 SPACES)"
DE 1050 POSITION 0,23:? #6;"choose l
      evel ";CHR$(17);CHR$(13);CHR
      $(22);CHR$(26);" ";LEVEL
CA 1060 IF PEEK(764)<255 THEN GET #2
      ,K:IF K>ASC("0") AND K<ASC("
      7") THEN LEVEL=K-48:LVL=70-(
      LEVEL*10)
HF 1070 IF PEEK(53279)<>3 THEN 1100
NI 1080 IF OP=0 THEN OP=1:GOTO 1040
NI 1090 IF OP=1 THEN OP=0:GOTO 1030
HD 1100 IF PEEK(53279)=5 THEN CLOSE
      #2:GOTO 2100
BD 1110 IF PEEK(53279)=6 THEN CLOSE
      #2:GOTO 10
MB 1120 GOTO 1030
KA 1999 REM STEAL & MODIFY CHARACTER
       SET
JD 2000 POKE 559,0:DIM S$(1024)
DN 2010 A=ADR(S$):B=INT(A/512+1)*2:C
      BASE=B*256-A+1
JL 2020 FOR I=0 TO 511
PI 2040 S$(CBASE+I,CBASE+I)=CHR$(PEE
      K(I+57344)):NEXT I:H=16:V=23
ID 2060 FOR CT=0 TO 8
HH 2070 FOR I=H TO V
KH 2080 READ W:S$(CBASE+I,CBASE+I)=C
      HR$(W):NEXT I:V=V+8:H=H+8
IM 2090 NEXT CT:LVL=60:LEVEL=1
PB 2100 GRAPHICS 17:POKE 756,B:POKE
      710,152:POKE 708,38:? #6;" t
      hings in the dark "
KD 2110 ? #6;" LAND THE ROBOT ";CHR$
      (162);" ON"
HH 2120 ? #6;"GREMLINS...";CHR$(5);"
        10 PTS":? #6;"BLOCKHEADS."
      ;CHR$(4);" 100 PTS"
BE 2130 ? #6;"SNAKES.....";CHR$(134)
      ;" 200 PTS":? #6;"PINK GRAPS
      .";CHR$(136);" 400 PTS"
JB 2140 ? #6;" AVOID THE NORFS ";CHR
      $(35);"  BOTH THE ROBOT AND
       THE NORF VANISH WHENTHEY TO
      UCH."
LO 2150 ? #6;? #6;" TOUCHING AN ORAN
      GE GRAP ";CHR$(41);" IS LIKE
      (6 SPACES}TOUCHING A NORF."
HJ 2160 ? #6;? #6;? #6;"(4 SPACES}pr
      ess select(8 SPACES}to conti
      nue"
IB 2170 IF PEEK(53279)<>5 THEN 2170
CK 2200 POSITION 0,0:? #6;"(CLEAR} T
      HE ROBOT ";CHR$(162);" GRAP
      ";CHR$(136);" AND SNAKE ";CH
      R$(134);" CAN"
MD 2210 ? #6;"LAND ON A DINIT ";CHR$
      (170);"(3 SPACES}BUT A GREML
      IN ";CHR$(5);"(5 SPACES}BLOC
      KHEAD ";CHR$(4);" OR"
JA 2220 ? #6;"NORF ";CHR$(35);" CANN
      OT.":? #6:? #6;" number of t
      urns to in which to score
      (3 SPACES}per level 1"
PH 2230 ? #6;"------------":? #6:? #
      6;"1  70":? #6:? #6;"1   60
      YOU MUST(5 SPACES}2   50  SCO
      RE BEFORE"
EJ 2240 ? #6;"3   40  TURN 70":? #6;"
      4   30  REACHS 0."
FP 2250 ? #6;"5   20":? #6;"6   10"
HN 2290 ? #6:? #6:? #6;"(4 SPACES}pr
      ess select(8 SPACES}to conti
      nue"
JB 2295 IF PEEK(53279)<>5 THEN 2295
BN 2300 POSITION 0,0:? #6;"(CLEAR} G
      RAPS REMAIN PINK ";CHR$(136)
      ;"UNTIL THE GRAP COUNTech RE
      ACHS 0."
KJ 2310 ? #6:? #6;" YOU EARN 1 CHANC
      E  AT A SNAKE ";CHR$(134);"
      EVERY  1000 PTS, AND AT A"
NA 2320 ? #6;"GRAP ";CHR$(136);" EVE
      RY SNAKE ";CHR$(134)
KH 2330 ? #6;" YOU EARN 1 ROBOT ";CH
      R$(162);" EVERY 2500 PTS.":?
       #6
NK 2340 ? #6;" PRESS THE TRIGGER  TO
       STOP OR CONTINUE A GAME."
MB 2400 GOTO 1010
DC 2500 REM DATA FOR ROBOT,NORF,BLOC
      KHEAD,GREMLIN,SNAKE(R),SNAKE
      (L),GRAP(162),GRAP(41),DINIT
IC 2510 DATA 24,36,24,126,90,90,24,6
      0
IC 2520 DATA 126,153,255,195,90,126,
      36,102
BH 2530 DATA 126,90,126,255,24,60,36
      ,102
LO 2540 DATA 24,36,24,60,126,60,66,1
      95
NP 2550 DATA 0,0,12,190,245,67,0,0
BG 2560 DATA 0,0,48,121,175,194,0,0
PB 2570 DATA 66,126,90,60,231,129,19
      5,0
PC 2580 DATA 66,126,90,60,231,129,19
      5,0
GA 2590 DATA 65,93,42,28,42,73,20,54
FD 2599 REM DATA FOR GRAP MOVEMENT
DG 2600 DATA 600,620,580,600,620,600
```

BREAKDANCE.™
BREAKIN' MADE EASY.

The hottest craze in the U.S. this fall is Breakdancing, and you don't have to miss it. Now anyone can Breakdance. Just grab your joystick and control your Breakdancer in poppin, moon walking, stretching and breaking...all on your computer screen.

Breakdance, the game, includes an action game in which your dancer tries to break through a gang of Breakers descending on him, a "simon-like" game where the dancer has to duplicate the steps of the computer-controlled dancer and the free-dance segment where you develop your own dance routines and the computer plays them back for you to see. There's even a game that challenges you to figure out the right sequence of steps to perform a backspin, suicide or other moves without getting "wacked."

Learn to Breakdance today! Epyx makes it easy!

One or two players; joystick controlled.

EPYX™ COMPUTER SOFTWARE

Strategy Games for the Action-Game Player

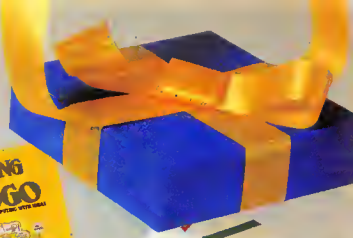
```
        ,620,580,560,580,600,620,560
        ,620,600,580,600,620,620,600
        ,620,600,99
MH 2700 IF STRIG(0)=0 THEN 2700
NC 2705 IF STRIG(0)=1 THEN 2705
JE 2710 IF STRIG(0)=0 THEN 140
```

Program 2: Things In The Dark For 64

Version by Kevin Mykytyn, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 POKE52,48:POKE56,48:CLR:GOSUB540:GOSU
    B690:GOSUB980                          :rem 77
110 GOSUB840:GOSUB920:POKE53281,0:rem 203
120 IFNM=0THENPRINT"{HOME}{DOWN}"TAB(31)"
    {6 SPACES}":GOTO1040                   :rem 86
130 PRINT"{HOME}{DOWN}"TAB(32)"{7 SPACES}
    "                                      :rem 90
140 IFNM>1THENFORA=1TONM-1:PRINT"{HOME}
    {DOWN}{YEL}"TAB(32+A);"!";:NEXT
                                           :rem 169
150 TU=55-5*LV:T1=TU:PRINT"{3 SPACES}"
                                           :rem 196
160 PRINT"{HOME}{4 DOWN}**********
    **********************"               :rem 79
170 T1=T1-U                                :rem 97
180 IFSC>=SSTHENSS=SS+1000:SF=1:POKESX,BL
    :SX=INT(RND(1)*10)*V+M1:GR=.:POKEGX,B
    L                                      :rem 10
190 PRINT"{HOME}{DOWN}{2 SPACES}GC:"GC"
    {LEFT} ":PRINT"{HOME}{3 DOWN}
    {2 SPACES}SCORE:"SC"{5 SPACES}L:"LV"
    {8 SPACES}T:"T1"{LEFT}{2 SPACES}"
                                           :rem 255
200 IFSFTHENGOSUB440                       :rem 1
210 IFSC-LC=>5000ANDAD=UTHENLC=LC+FV:LV=L
    V+1:IFLV>6THENLV=6                     :rem 41
220 IFSC-BC>=2500THENBC=BC+2500:NM=NM+1:G
    OTO140                                 :rem 38
230 IFGRTHENGOSUB500                       :rem 1
240 IFPEEK(M4)=111THENGOSUB1120            :rem 95
250 WAITM4,M7,.:JV=M5-(PEEK(M4)ANDM5)
                                           :rem 186
260 IFJVTHENPOKEX1,BL:X1=X1+JY(JV):POKEV1
    ,33:J2=JV                              :rem 197
270 IFT1=.THENPOKES+4,32:GOSUB1000:GOTO10
    40                                     :rem 108
280 KX=X1:GOSUB1090:X1=KX                  :rem 42
290 PE=PEEK(X1):POKEV1,32:ONPE-31GOTO370,
    370,300,310,320,330,330,340,340,370
                                           :rem 147
300 GOSUB1000:GOTO120                      :rem 218
310 SC=SC+100:LS=LS+100:T1=TU:GOTO370
                                           :rem 220
320 SC=SC+10:LS=LS+10:T1=TU:GOTO370
                                           :rem 125
330 SC=SC+200:LS=LS+200:T1=TU:GR=U:SF=0:G
    C=50-2*LV:CG=3:GX=M1+M3*RND(U):GOTO37
    0                                      :rem 61
340 CG=PEEK(X1+C)AND15                     :rem 4
350 IFCG=3THENSC=SC+400:LS=LS+400:T1=TU:G
    R=.:POKEGX,BL:GOTO370                  :rem 15B
360 GOSUB1000:GOTO120                      :rem 224
370 POKEX1,RO:POKEX1+C,U                   :rem 0
380 IFRND(U)<FTHENFORT=1TO20:NEXT:GOTO170
                                           :rem 151
390 W=RND(U)*M3+M1:PW=PEEK(W):V=INT(RND(U
    )*4)+1:PV=ME(V,U):PC=ME(V,TW)          :rem 54
400 IFPW<>BLANDPV<>DITHEN170               :rem 25
410 IFPV=DITHENW=PD-U:PD=W                 :rem 207
420 IFPV=DIANDPEEK(W)<>BLTHENW=RND(U)*M3+
    M1:PD=W                                :rem 63
430 POKEW,PV:POKEW+C,PC:GOTO170            :rem 231
440 KX=SX:KX=KX+1:J=PEEK(KX)               :rem 22
450 IFJ<>BLANDJ<>DITHENKX=KX+39:GOSUB1090
    :J=PEEK(KX):IFJ<>BLANDJ<>DITHEN470
                                           :rem 78
460 POKESX,BL:SX=KX:GOTO490                :rem 3
470 KX=KX-80:GOSUB1090:J=PEEK(KX):IFJ<>BL
    ANDJ<>DITHEN490                        :rem 28
480 GOTO460                                :rem 111
490 POKESX,SN:POKESX+C,8:RETURN            :rem 68
500 KX=GX:KX=KX+JY(RND(1)*5):GOSUB1090:IF
    PEEK(KX)=BLTHENPOKEGX,BL:GX=KX:rem 86
510 POKEGX,39:POKEGX+C,CG:GC=GC-1 :rem 17
520 IFGC<=.THENGC=.:GR=0:POKEGX+C,4
                                           :rem 145
530 RETURN                                 :rem 120
540 TH$="{Y}O- .{DOWN}{4 LEFT}{G}{Q}I-{Q}
    IUIUI{DOWN}{10 LEFT}{G}-------JI
    {DOWN}{10 LEFT}{G}-----J{W}JK":rem 71
550 TH$=TH$+"{DOWN}{4 LEFT}JK":D$="{RVS}
    {SPACE}{OFF} {RVS} {OFF} {RVS} {OFF}
    {SPACE}{RVS} {OFF} {RVS} {OFF} {RVS}
    {SPACE}{OFF} {RVS} {OFF} {RVS} ":C$="
    {DOWN}{15 LEFT}"                       :rem 247
560 A$="{RVS}{2 SPACES}{*}{OFF} {RVS}{*}
    {OFF} {RVS}{2 SPACES}{*}{OFF}
    {RVS} {OFF} {RVS} "+C$+D$+C$+D$
                                           :rem 179
570 A$=A$+C$+"{RVS} {OFF} {RVS} {OFF}
    {RVS}{3 SPACES}{OFF} {RVS}{2 SPACES}
    {OFF} {RVS}{2 SPACES}{OFF}{ {RVS}
    {OFF} {RVS} {OFF} {RVS} {OFF} {RVS}
    {OFF} {RVS} {OFF} "                    :rem 209
580 A$=A$+"{RVS} ":POKE53281,0             :rem 237
590 PRINT "{CLR}{2 DOWN}{WHT}{7 RIGHT}"TH
    $"{3 DOWN}IN{2 DOWN}{3 LEFT}THE
    {4 DOWN}{5 LEFT}"A$C$"{2 DOWN}
    {2 RIGHT}{RVS}PLEASE WAIT";            :rem 153
600 POKE56334,PEEK(56334)AND254:POKE1,PEE
    K(1)AND251                             :rem 183
610 FORI=0TO511:POKEI+12288,PEEK(I+53248)
    :NEXT:POKE1,PEEK(1)OR4                 :rem 39
620 POKE56334,PEEK(56334)OR1:PRINT"{CLR}"
    :POKE53272,(PEEK(53272)AND240)OR12
                                           :rem 178
630 FORI=12552TO12631:READA:POKEI,A:NEXT:
    RETURN                                 :rem 238
640 DATA24,36,24,126,90,90,24,60,126,153,
    255,195,90,126,36,102                  :rem 31
650 DATA126,90,126,255,24,60,36,102,24,36
    ,24,60,126,60,66,195                   :rem 237
660 DATA0,0,12,190,245,67,0,0,0,0,48,121,
    175,194,0,0,66,126,90,60,231,129,195,
    0                                      :rem 63
670 DATA66,126,90,60,231,129,195,0,65,93,
    42,2B,42,73,20,54                      :rem 98
680 DATA 0,0,0,0,0,255,0,0,0               :rem 216
690 POKE532B1,0:PRINT"{CLR}{DOWN}{WHT} LA
    ND THE ROBOT.. ! ON GREMLINS.. {BLU}$
    {WHT} 10"                              :rem 231
700 PRINT" PTS: BLOCKHEADS.. {GRN}#{WHT}
    {SPACE}100 PTS: SNAKES.. "             :rem 23B
710 PRINT" {YEL}%{WHT} 200 PTS: CYAN GRAP
    S...{CYN}'{WHT} 400 PTS."              :rem 170
720 PRINT"{DOWN} AVOID THE NORFS.. {RED}"
    ;CHR$(34);:POKE646,1:PRINT". BOTH THE
    "                                      :rem 171
730 PRINT" ROBOT AND THE NORF DISAPPEAR W
    HEN THEY"                              :rem 223
```

The gifts computer users can't wait to open



Introduction to Apple II+ Keyboarding

By Peter Mears. Put an end to "hunt and peck" on the micro with a gift designed to improve keyboarding skills *fast.* Featuring a wide variety of exercises and drills graded by difficulty, this combination book and disk set makes an ideal practice package. $40.45

Arcade Games for the Commodore 64

By Fanfare House Inc. Software as challenging as it is entertaining. By using the documentation in the book, players can change the 12 original games into hundreds of new ones...and learn programming at the same time! Disk with complete documentation. $32.95

Exploring the NEC PC 8201

By Marvin C. Mallon. *The first complete guide* to getting the most out of NEC's popular new portable for people on the go. Includes a clear explanation of its operation and capabilities; detailed descriptions of all available software; and much, much more. $18.45

The DEC Rainbow 100: Use, Applications and BASIC

By Eric W. Kiebler. Here's the book every DEC Rainbow 100 owner has been waiting for! Filled with examples, it explains everything from BASIC essentials to the procedures for using subroutines and writing programs. $18.45

Your TI Professional Computer: Use, Application and BASIC

By Thomas W. Madron and C. Neal Tate. How to use TI's successful business personal computer to boost productivity—with in-depth chapters on financial modeling and database management, and appendices listing information and software sources. $20.45

COMPAQ Portable Computer: Use, Application and BASIC

By William R. Arnold. Examples for both home and office use highlight this much-needed "hands on" guide that helps beginners and pros *learn as they operate* the COMPAQ. Find out how to program DOS and BASIC; format diskettes; batch process; write or copy programs; and much, much more. $19.45

The Business Microcomputer Handbook: Evaluation, Acquisition and Use

By Louis Fry and Marcia Adams. *Do I really need a computer? Which one should I buy? How much will it cost?* Two experts supply up-to-the-minute answers and take a hard look at true cost and contract negotiation—subjects covered *only* in this book. *With worksheets and checklists.* $19.45

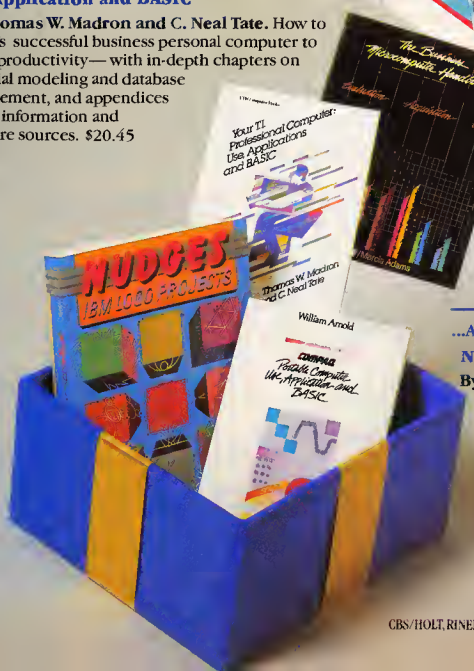
Thinking About (TLC) LOGO: A Graphic Look at Computing with Ideas

By J. R. Allen, R. E. Davis and J. F. Johnson. Delight your favorite LOGO-phile with "an irreverent, freewheeling discussion of sophisticated computational ideas...[that provides] a feeling for the proper breadth and perspective of LOGO."—*The National Logo Exchange.* $17.45

...And a FULL-COLOR activity book for the whole family!

Nudges: IBM LOGO Projects

By Steve Tipps et al. Close to 100 projects focusing on math, art, music, and logic make learning LOGO fun for all ages. Written with the technical support of IBM. $16.95



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When A Help Command Isn't Enough

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```
740 PRINT" TOUCH. TOUCHING A PURPLE GRAP
    {SPACE}IS LIKE{3 SPACES}TOUCHING A NO
    RF."                              :rem 135
750 PRINT"{DOWN} THE ROBOT, GRAP AND SNAK
    E CAN LAND ON A";                 :rem 138
760 PRINT" DINIT "CHR$(41)" BUT A GREMLIN
    , BLOCKHEAD OR{5 SPACES}NORF CANNOT."
                                      :rem 139
770 PRINT"{DOWN} YOU MUST SCORE BEFORE TH
    E TURN COUNTER"                   :rem 63
780 PRINT" T: REACHES Ø. THE GRAPS REMAIN
     CYAN"                            :rem 156
790 PRINT" UNTIL THE GRAP COUNTER GC: REA
    CHES Ø.                           :rem 35
800 PRINT"{DOWN} YOU EARN ONE CHANCE AT A
     SNAKE EVERY"                     :rem 244
810 PRINT" 1000 POINTS AND AT A GRAP EVER
    Y SNAKE."                         :rem 6
820 PRINT"{DOWN} PRESS FIREBUTTON TO FREE
    ZE ACTION."                       :rem 91
830 PRINT"{DOWN}{5 SPACES}PRESS ANY KEY T
    O CONTINUE";:WAIT198,1:RETURN:rem 166
840 PRINT"{CLR}{4 DOWN}{5 SPACES}ADVANCE
    {SPACE}OR NO ADVANCE A/N ";       :rem 95
850 GETA$:IFA$<>"A"ANDA$<>"N"THEN850
                                      :rem 31
860 PRINT A$                          :rem 144
870 IFA$="A"THENAD=1                  :rem 119
880 IFA$="N"THENAD=Ø                  :rem 132
890 PRINT"{3 DOWN}{4 SPACES}LEVEL 1-6 , 1
     IS THE EASIEST ";                :rem 212
900 GETA$:IFA$<"1"ORA$>"6"THEN900     :rem 67
910 PRINT A$:LV=VAL(A$):PRINT"{CLR}"
                                      :rem 220
920 NM=2:GC$="":JY(1)=-40:JY(2)=40:JY(4)=
    -1:JY(8)=1:X1=1524:JY(3)=Ø:V=40
                                      :rem 216
930 JY(5)=-41:JY(6)=39:JY(7)=Ø:JY(9)=-39:
    JY(10)=41                         :rem 225
940 C=54272:M1=1224:M2=2023:M3=800:M4=563
    20:M5=15:SN=37:U=1:F=.7:TW=2      :rem 119
950 S=54272:FORK=STOS+24:POKEK,Ø:NEXT:POK
    ES+24,15:DX=1:LC=Ø:BC=Ø:FV=5000
                                      :rem 155
960 BL=32:M7=16:RO=33:DI=41:V1=54276:POKE
    54273,10:POKE54277,Ø:POKE54278,240
                                      :rem 28
970 PD=1400:SX=2025:LS=Ø:SC=Ø:GC=Ø:GR=Ø:S
    F=Ø:SS=1000:RETURN                :rem 77
980 FORA=1TO4:FORB=1TO2:README(A,B):NEXTB
    ,A:RETURN                         :rem 222
990 DATA 34,2,35,5,36,6,41,1          :rem 91
1000 NM=NM-1                          :rem 146
1010 POKES+18,33:POKES+19,17:POKES+20,240
                                      :rem 90
1020 FORZ1=1TO3:FORZ2=20TOØSTEP-1:POKES+1
     8,33:POKES+15,Z2:POKES+18,32:rem 250
1030 NEXTZ2,Z1:POKEX1,BL:X1=1524:POKEX1,B
     L:RETURN                         :rem 132
1040 POKES+24,Ø:PRINT"{HOME}{DOWN}
     {16 RIGHT}GAME OVER"             :rem 137
1050 PRINT"{15 RIGHT}PLAY AGAIN?" :rem 31
1060 GETA$:IFA$<>"Y"ANDA$<>"N"THEN1060
                                      :rem 139
1070 IFA$="Y"THEN110                  :rem 87
1080 POKE828,Ø:SYS828                 :rem 209
1090 IFKX<M1THENKX=KX+M3              :rem 19
1100 IFKX>M2THENKX=KX-M3              :rem 16
1110 RETURN                           :rem 163
1120 WAITM4,M7,Ø:WAITM4,M7,M7:RETURN
                                      :rem 240
```

Program 3: Things In The Dark, VIC Loader

Version by Kevin Mykytyn, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 POKE52,28:POKE51,Ø:POKE56,28:POKE55,Ø
    :CLR                              :rem 156
110 TH$="{G}O- .{DOWN}{4 LEFT}{G}{Q}I-{Q}
    IUIUI{DOWN}{10 LEFT}{G}-------JI
    {DOWN}{10 LEFT}{G}-----J{W}JK":rem 64
120 TH$=TH$+"{DOWN}{4 LEFT}JK":D$="{RVS}
    {SPACE}{OFF} {RVS} {OFF} {RVS} {OFF}
    {SPACE}{RVS} {OFF} {RVS} {OFF} {RVS}
    {SPACE}{OFF} {RVS} {OFF} {RVS} ":C$="
    {DOWN}{15 LEFT}"                  :rem 240
130 A$="{RVS}{2 SPACES}{*}{OFF} {RVS}{
    {*}{OFF} {RVS}{2 SPACES}{*}{OFF}
    {RVS} {OFF} {RVS} "+C$+D$+C$+D$
                                      :rem 172
140 A$=A$+C$+"{RVS} {OFF} {RVS} {OFF}
    {RVS}{3 SPACES}{OFF} {RVS}{2 SPACES}
    {OFF}{ {RVS}{2 SPACES}{OFF}{"+C$+D$
    +C$+"{RVS}{2 SPACES}{OFF}{ {RVS}
    {OFF} {RVS} {OFF} {RVS} {OFF} {RVS}
    {OFF} {RVS} {OFF} "               :rem 202
150 A$=A$+"{RVS} ":POKE36879,8        :rem 252
160 PRINT "{CLR}{DOWN}{WHT}"TH$"{3 DOWN}I
    N{2 DOWN}{3 LEFT}THE{4 DOWN}{5 LEFT}"
    A$C$"{2 DOWN}{2 RIGHT}{RVS}PLEASE WAI
    T";                               :rem 182
170 FORI=ØTO511:POKEI+7168,PEEK(I+32768):
    NEXT                              :rem 187
180 PRINT"{CLR}":POKE36869,255        :rem 62
190 FORI=7432TO7511:READA:POKEI,A:NEXT
                                      :rem 119
200 DATA24,36,24,126,90,90,24,60,126,153,
    255,195,90,126,36,102             :rem 23
210 DATA126,90,126,255,24,60,36,102,24,36
    ,24,60,126,60,66,195              :rem 229
220 DATAØ,Ø,12,190,245,67,Ø,Ø,Ø,Ø,48,121,
    175,194,Ø,Ø,66,126,90,60,231,129,195,
    Ø                                 :rem 55
230 DATA66,126,90,60,231,129,195,Ø,65,93,
    42,28,42,73,20,54                 :rem 90
240 DATA Ø,Ø,Ø,Ø,255,Ø,Ø,Ø           :rem 208
250 PRINT"{CLR}{DOWN}{WHT} LAND THE ROBOT
    .. ! ONGREMLINS.. {BLU}${WHT} 10";
                                      :rem 82
260 PRINT" PTS:{2 SPACES}BLOCKHEADS..
    {GRN}#{WHT} 100 PTS: SNAKES..";
                                      :rem 42
270 PRINT" {YEL}%{WHT} 200 PTS: CYAN GRAP
    S..{CYN}'{WHT} 400 PTS.";         :rem 184
280 PRINT"{DOWN} AVOID THE NORFS.. {RED}"
    ;CHR$(34);:POKE646,1:PRINT". BOTH THE
     ROBOT";                          :rem 109
290 PRINT" AND THENORF DISAPPEAR WHEN"
                                      :rem 32
300 PRINT"THEY TOUCH. TOUCHING{2 SPACES}A
     PURPLE GRAP IS LIKE TOUCHING A NORF.
    "                                 :rem 185
310 PRINT"{DOWN} THE ROBOT, GRAP AND
    {2 SPACES}SNAKE CAN LAND ON A":rem 71
320 PRINT"DINIT..) BUT A GREMLIN,BLOCKHEA
    D OR NORF{4 SPACES}CANNOT."       :rem 13
330 PRINT"{2 DOWN}{5 SPACES}HIT ANY KEY":
    WAIT198,1                         :rem 173
340 PRINT"{6 DOWN} YOU MUST SCORE BEFORET
    HE TURN COUNTER T:"               :rem 27
350 PRINT"REACHES Ø. THE GRAPS{2 SPACES}R
    EMAIN CYAN UNTIL THE"             :rem 116
```

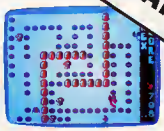
TRIAD

by Ed Hobbs
Color Computer Version by Jeff Francis

The imaginative game scenario centers around a master tic-tac-toe board. Score an "X" by selecting and successfully battling one of nine weird foes. Three X's in a row and Bingo! — you automatically advance to the next level! But the core of TRIAD is the colorful hi-resolution graphics and great sounds. They simply have to be experienced firsthand!

TRIAD excells in the "frills department," too — keyboard or joystick option, game freeze, running high score and more. And a succession of teeth-gritting skill levels is guaranteed to test the eye-to-hand coordination of the most valiant of armchair warriors. Joystick required on Commodore version.

APPLE 2 DOS 3.3 Required Flippy Disk 48K
ATARI 400/800
102-0173 $34.95 (£25.49 inc. VAT)
Color Computer 16K Tape
060-0173 $34.95 (£25.47 Inc. VAT)
Commodore 64 version distributed by Commodore



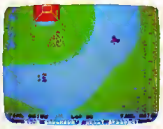
AREX

by William Muk
Commodore 64 Versions by Phil Case
Atari Version by John Anderson
Color Computer Version by Roger Schrag

AREX — Enter and neutralize at least 90% of the enemy's territory while avoiding 3 distinct types of alien ships. A successful invasion earns advancement to subsequent (and, of course, more difficult) levels of play.

AREX features phenomenal graphics routines, high score retention, one- or two-player option and multiple skill levels.

ATARI 16K TAPE	050-0172	$34.95	(£25.49 inc. VAT)
ATARI 16K DISK	052-0172	$34.95	(£25.49 inc. VAT)
COMMODORE 64 TAPE	090-0172	$34.95	(£25.49 inc. VAT)
COMMODORE 64 DISK	092-0172	$34.95	(£25.49 inc. VAT)
COLOR COMPUTER 16K TAPE	060-0172	$34.95	(£25.49 inc. VAT)
TRS-80 16K TAPE Model 1 & 3	010-0172	$34.95	(£25.49 inc. VAT)
TRS-80 32K DISK Model 1 & 3	012-0172	$34.95	(£25.49 inc. VAT)



ATARI

Winner of 1984 CES Showcase Award

RALLY SPEEDWAY

by John Anderson

A colorful, scrolling roadscape serves as an exciting backdrop for fun-injected action — choose one of several different courses provided or "construct" your own. Players are challenged to hot rod their joystick-controlled cars down grueling straightaways, around hairpin corners and past an ever-changing landscape that includes houses, lakes, orchards and more. Work on improving your lap time with a solo game, or invite a friend along for a one-on-one duel to the finish line — there's plenty of excitement to go around! Joystick required.

ATARI 16K Cartridge
053-0171 $49.95 (£35.99 inc. VAT)
Commodore 64 version distributed by Commodore

Nominated for 1985 Electronics Games Magazine, Game of the Year.

APPLE
ATARI
COM. 64

C'EST LA VIE

by Gordon Eastman

It's a dream come true! The streets are littered with $10, $20 and $50 bills, and you're challenged to collect as many bucks as you can. But there are flies in this financial ointment — thieves and tax men abound. A loan from your friendly neighborhood loan shark may tide you over, but you'd better repay him on time or else!

Great graphics and sounds. For one or two players. Joystick optional.

APPLE 2 48K DISK DOS 3.3	042-0218	$34.95	(£25.49 Inc. VAT)
ATARI 48K DISK	052-0218	$34.95	(£25.49 Inc. VAT)
ATARI 48K TAPE	050-0218	$34.95	(£25.49 Inc. VAT)
COMMODORE 64 DISK	192-0218	$34.95	(£25.49 Inc. VAT)
COMMODORE 64 TAPE	190-0218	$34.95	(£25.49 Inc. VAT)

Commodore Plus/4 distributed by Commodore

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NEW

WHOMPER STOMPER

by Mario Inchiosa and Mike Wall

The weekend sun beamed warmly over Bill Bunion and his long awaited picnic lunch. "Nothing can go wrong on a day like today," he thought lazily.

Wrong! Just as Bill finally began to unwind . . . ants! A wave of the dreaded pests on his food. Wildly stomping, Bill attempted to annihilate his small enemies, helped by Artie, his ever ravenous aardvark.

But other dangers lurked. Birds, obviously in league with the ants, bombarded him with their lethal weapons. Can he dodge them while saving his picnic basket from the ants?

Features multiple skill levels. Joystick required. (Whomper Stomper on C64 soon to be released).

ATARI DISK 48K	52-0230	$29.95
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MAXI® GOLF

Endorsed by the world's golf "fun" pro's Chi Chi Rodriquez & Fuzzy Zoeller.

by John Horan

So what if it's raining! MAXI GOLF, an incredibly realistic golf simulation for 1 to 4 players, will have you on the greens faster than you can say "FORE." This beautiful high resolution golf course is always perfect for teeing off, no matter what the weather or time of day.

There are many features that will help you practice your swing or to make that birdie. You can alter your stance, choose any variation of club, change the swing speed and add a hook or slice to the ball. The two golf courses provided come complete with those dreaded water hazards, sand traps and roughs.

After becoming the pro of your neighborhood, have your own challenging tournament. Just to make it interesting, utilize the most unique feature of the game - the Course Designer - to create the golf course of your dreams.

MAXI GOLF is a fine blend of strategy, judgement, and playing skill, and is highly recommended for all players.

APPLE 2 DISK	42-0228	$29.95
ATARI 48K DISK	52-0228	$29.95
COMMODORE 64 DISK	192-0228	$29.95

OLIN IN EMERALD

by Gordon Morrell, PhD, and George Taylor, M.S. Graphics by Sheila Morrell, "Graphics created with Penguin Software's Graphics Magician"

Imagine going on a treasure hunt past a sea of chocolate syrup and sharing your peanut butter and jelly sandwich with a hungry critter! You can do all this as well as help good King Olin escape from the clutches of the evil sorcerer Vargor.

As you travel on this graphic adventure through the Kingdom of Myrrh, you must write down all the clues you find. It will be helpful for you to draw a map of Myrrh so you don't get lost, and you'll get lots of practice using your decision making skills as you and Anara, your companion on the journey through Myrrh, try to find King Olin.

Note to Parents: Author Gordon Morrell, PhD. in Education from the University of California, has had several years of teaching experience and has published COMPUTER EASE, a book on selecting a personal computer. George Taylor has a B.A. in Mathematics from the University of California, and earned his M.S. from the University of Utah.

APPLE 2 DISK	42-0229	$29.95
ATARI 48K DISK	52-0229	$29.95

KINGDOM OF FACTS

by Gordon Morrell, PhD, and George Taylor, M.S. Graphics by Sheila Morrell, "Graphics created with Penguin Software's Graphics Magician"

Engage in a "battle of wits" in the exciting KINGDOM OF FACTS! Choose your own skill level, and compete against your friends in four categories: Words (spelling and vocabulary), Social Science (history and geography), Math and Science, and Trivia, all selected from current elementary school textbooks.

You can even enter your own sets of questions with the Text Editor section. This feature ensures that parents, children and teachers will be able to use this program to enhance learning for a long, long, time.

This second of a series featuring the Kingdom of Myrrh characters will delight players of all ages, and even more important, will make learning fun. And when you get down to it, that's what counts!

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APPLE DISK	42-0232	$29.95
IBM DISK	132-0232	$29.95

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by Scott Adams

Listen up, True Believer! The world's premier comics company has joined with the originator of Adventure games to bring you the awesome QUESTPROBE[tm] series: an epic group of home computer Adventures by Marvel Comics and Scott Adams in which you become the greatest Marvel Superheroes[tm].

In this first QUESTPROBE[tm], you become Bruce Banner (and the HULK[tm]). You will encounter such dastardly villians as Ultron and Nightmare, and some good guys such as Ant Man and Doctor Strange. You'll find yourself in some pretty strange places, and you'll have to rely on the Hulk's strength to make it through. You might even be lucky enough to solve the riddle of the Chief Examiner[tm].

Some versions with graphics.

All QUESTPROBE[tm] disk versions (except TRS 80) are available through Commodore & sold retail by Adventure.

ATARI 48K TAPE	50-0225	$29.95
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TRS COCO 16K TAPE	60-0225	$29.95
TRS 80 Mod 1 & 3 & 4 48K DISK	12-0225	$29.95
IBM DISK	132-0225	$29.95*
APPLE DISK	042-0225	$29.95*
C64 DISK	192-0225	$29.95*

***Available retail only. Note prices subject to change without notice.**

SPIDER-MAN™

by Scott Adams

Here's the second installment of the QUESTPROBE[tm] series, and True Believers, you're in for a treat. It's not business as usual at the Daily Bugle, or with our hero, Spider-Man[tm]. Instead of cuddling with a cutie, he's battling it out with Lizard[tm], Hydroman[tm], and Mysterio[tm].

Once again you have the opportunity to command the powers of a Marvel Superhero[tm] as Spider-Man[tm] is faced with new and exciting challenges. Even the help of Madame Web[tm] might not be enough to get you through this one.

Become Spider-Man, and climb walls, sling webs, and perhaps solve the riddle of the Chief Examiner.

Graphics on some versions . . . Disk versions available through Commodore.

ATARI 48K TAPE	50-0226	$29.95
COMMODORE C64 TAPE	190-0226	$29.95
TRS CoCo 16K TAPE	60-0226	$29.95
TRS 80 Mod 1 & 3 & 4 48K DISK	12-0226	$29.95

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BUCKAROO BANZAI™

by Scott Adams and Phil Case

You saw the hit movie, now play the adventure! Join the members of the Banzai Institute as they solve the mysteries of the universe with Buckaroo Banzai[tm].

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As Buckaroo says, "The only reason for time is so that everything does not happen at once."

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ADVENTURE

THE ADVENTURE SERIES: AN OVERVIEW

By definition, an adventure is a dangerous or risky undertaking. On your personal computer, Adventure is that and more!

Playing any of the Adventures includes three elements: you, the user: the games themselves; and the author, Scott Adams of Orlando, Florida.

In beginning any Adventure, you will find yourself in a specific location: in a forest, maybe on board a small spaceship, or perhaps in a desert. The top portion of your video display will tell you where you are and what you see; the bottom section of the display is devoted to inputting commands to your robot computer and receiving messages that may arise as the result of your orders.

By using two-word commands you move from location to location (they're called "rooms", though some rooms represent outdoor sites like a swamp), manipulate objects that you find in different rooms (pick them up, put them down, carry them, etc.) and perform actions as if you were really there.

The object of the game is to amass treasure for points or accomplish a specified task. Successfully completing a game, however, is far easier to discuss than to achieve. In many cases you will find a treasure but be unable to take it until you are carrying the right combination of objects that you'll find in various locations.

If you're tired of video games with bouncing balls, or bored with shooting at targets, and you're ready for an intellectual challenge that transports you to new worlds of experience; if you want to see what a skilled programmer can do with a micro, then invest in one of Scott Adams' games. An early Adventure (Adventureland or Pirate Adventure) is a good place to start, because the more Adams creates, the tougher his puzzles get.

by Ken Mazur

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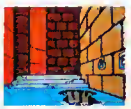
THE GRAPHIC ADVENTURES

As the name implies, the Scott Adams Graphic Adventures are Scott's classic text Adventures enhanced with exciting hi-res graphics — graphics which colorfully depict your voyage into wonderment each and every step of the way. Each Adventure challenges the player to accumulate points, crack a mystery or accomplish a goal using the unique tools of Adventuring: two-word commands, some common sense and a little ingenuity.

If you've never played an Adventure, here's the place to begin. If you're an experienced Adventurer, prepare for a magical encounter unlike any other. Remember: Anything can happen when you play a Scott Adams Graphic Adventure . . . and it usually does!

See individual descriptions on opposite page.



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1	042-0201 $39 95	052-0201 $39 95	051 0001 $19 95		190-0001 $29 95	110-0001 $29 95	060-0001 $19 95		† 1-2-3	†072-0010 $39 95	152-0010 $49 95
2	042-0202 $39 95	052-0202 $39 95	051-0002 $19 95		190-0002 $29 95	117-0002 $49 95	060-0002 $19 95		† 4-5-6	†072-0011 $39 95	152 0011 $49 95
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4	042-0204 $39 95	052-0204 $39 95	051-0004 $19 95		190 0004 $29 95	110-0004 $29 95	060-0004 $19 95		† 10-11-12	†072-0130 $39 95	152 0130 $49 95
5	042-0205 $39 95	052-0205 $39 95	051-0005 $19 95			110-0005 $29 95	060-0005 $19 95				
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HINT BOOK

Our hint book provides clues and solutions to help you out of those sticky spots you have gotten into, while still enabling you to solve the Adventure yourself. So if you can't seem to get out of the bog, or locate the Pharoah's heart, then you've come to the right place for help. This edition includes hints for all SCOTT ADAMS Adventures 1 - 14, PLUS SPIDER-MAN™, HULK™, and BUCKAROO BANZAI™. There is also a special section on the making of Adventure Maps. For those that just want answers, there is a solution section, too. But don't worry. All clues and solutions are specially encoded so that the only time you can get a clue or answer is when you want one.

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THE ADVENTURES

#1 ADVENTURELAND — Wander through an enchanted realm and try to uncover the 13 lost treasures. There are wild animals and magical beings to reckon with as well as many other perils and mysteries. This is the Adams Classic that started it all! Difficulty Level: Moderate

#2 PIRATE ADVENTURE — Only by exploring this strange island will you be able to uncover the clues necessary to lead you to your elusive goal -- recovering the lost treasures of Long John Silver. Difficulty Level: Beginner

#3 ADVENTURE #3 — In this exciting Adventure, time is of the essence as you race the clock to complete your mission in time- or else the world's first automated nuclear reactor is doomed! If you survive this challenging mission, consider yourself a true Adventurer! Difficulty Level: Advanced

#4 VOODOO CASTLE — The Count has fallen victim to a fiendish curse placed on him by his enemies. There he lies, with you his only possible hope. Will you pull off a rescue, or is he really down for the Count?! Difficulty Level: Moderate

#5 THE COUNT — It begins when you awake in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here and WHY did the postman deliver a bottle of blood? Difficulty Level: Moderate

#6 STRANGE ODYSSEY — At the galaxy's rim, there are rewards aplenty to be harvested from a long-dead alien civilization, including fabulous treasures and advanced technologies far beyond human ken! Prepare yourself for the Incredible! Difficulty Level: Moderate

#7 THE MYSTERY FUN HOUSE — As Adventure #7 begins, you find yourself hopelessly lost in the middle of a carnival fun house. While escape may elude you, one thing is very clear — you're NOT here to have a good time! Difficulty Level: Moderate

#8 PYRAMID OF DOOM — This is an Adventure that will transport you to a dangerous land of crumbling ruins and trackless desert wastes into the PYRAMID OF DOOM! Jewels, gold — it's all here for the plundering — IF you can find the way. Difficulty Level: Moderate

#9 GHOST TOWN — You must explore a once-thriving mining town in search of the 13 hidden treasures. With everything from rattlesnakes to runaway horses, it sure ain't going to be easy! Includes a special bonus scoring system too! Difficulty Level: Advanced

#10 SAVAGE ISLAND PART I — A small island holds an awesome secret — will you be able to discover it? This is the beginning of a two-part Adventure. (The story continues in SAVAGE ISLAND PART 2, ADVENTURE #11.) NOTE: This one's a toughie — for experienced Adventurers only! Difficulty Level: Advanced

#11 SAVAGE ISLAND PART II — The suspense begun in Adventure #10 now comes to an incredible conclusion with SAVAGE ISLAND PART II! This Adventure requires you to have successfully finished #10, wherein you were given the secret password to begin this final half. NOTE: For experienced Adventurers only! Difficulty Level: Advanced

#12 GOLDEN VOYAGE — The king lies near death in the royal palace. You have only three days to bring back the elixir needed to rejuvenate him. Journey through the lands of magic fountains, sacred temples, stormy seas and gold, gold, GOLD! This one is for experienced Adventures only! Difficulty Level: Advanced

#13 SCORCERER OF CLAYMORGUE CASTLE — Long ago, in times past beyond remembrance, Solon, the Master Wizard and wearer of the Secret Cloak, lost the 13 Stars of Power. Find the Stars within Claymorgue Castle, but beware! The castle harbors further spells, and one unskilled in the magical arts cannot predict their outcome. Difficulty level - Advanced.

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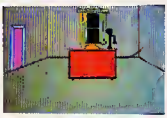

Jyym Pearson

Graphics by Normen Seller

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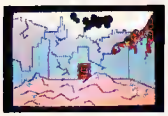

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EARTHQUAKE: SAN FRANCISCO 1906

As buildings crumble and the earth opens to swallow what remains, you stumble through the ruins of what was once beautiful San Francisco. Panic-stricken survivors flee around you, but you fear for more than your own life. When the quake hit, you were on your way to Oakland with the ransom for your kidnapped wife. Time is running out ... which way do you go? Skill Level: Moderate-Advanced

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```
360 PRINT"GRAP COUNTER GC:{6 SPACES}REACH
    ES Ø.                          :rem 175
370 PRINT"{DOWN} YOU EARN ONE CHANCE
    {2 SPACES}AT A SNAKE EVERY 1000"
                                   :rem 183
380 PRINT"POINTS AND AT A GRAP{2 SPACES}E
    VERY SNAKE. PRESS"             :rem 212
390 PRINT"THE FIREBUTTON AT ANY TIME TO F
    REEZE THE{4 SPACES}ACTION{BLK}"
                                   :rem 143
400 S$="LO"+CHR$(34)+"V5"+CHR$(34)+",8:"+
    CHR$(131)                      :rem 136
410 FORI=1TOLEN(S$):POKE630+I,ASC(MID$(S$
    ,I)):NEXT:POKE198,I:END        :rem 140
```

Program 4: Things In The Dark, VIC Main Program

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 POKE36879,8:POKE36869,255      :rem 118
110 GOSUB700                       :rem 169
120 GOSUB550:GOSUB640              :rem 1
130 IFNM=ØTHENPRINT"{HOME}{DOWN}"TAB(15)"
    {6 SPACES}":GOTO750            :rem 48
140 PRINT"{HOME}{DOWN}"TAB(15)"{6 SPACES}
    "                              :rem 92
150 IFNM>1THENFORA=1TONM-1:PRINT"{HOME}
    {DOWN}{YEL}"TAB(15+A);"!";:NEXT
                                   :rem 171
160 TU=55-5*LV:T1=TU               :rem 186
170 PRINT"{HOME}{DOWN}GC:";PRINT"{HOME}
    {3 DOWN}SC:{8 SPACES}L:{3 SPACES}T:"
                                   :rem 134
180 PRINT"{HOME}{4 DOWN}**********
    *****"                         :rem 93
190 T1=T1-U                        :rem 99
200 IFSC>=SZTHENSZ=SZ+1000:SF=1:POKESX,BL
    :SX=INT(RND(1)*10)*22+M1:GR=.:POKEGX,
    BL                             :rem 38
210 PRINT"{HOME}{DOWN}{3 RIGHT}"GC"{LEFT}
     ":PRINT"{HOME}{3 DOWN}{3 RIGHT}"SC:P
    RINT"{HOME}{3 DOWN}"SPC(13);LV:rem 81
220 PRINT"{HOME}{3 DOWN}"SPC(18);T1"
    {LEFT} "                       :rem 236
230 IFSFTHENGOSUB460               :rem 6
240 IFSC-LC=>5000ANDAD=UTHENLC=LC+FV:LV=L
    V+1:IFLV>6THENLV=6             :rem 44
250 IFSC-BC>=2500THENBC=BC+2500:NM=NM+1:G
    OTO150                         :rem 42
260 IFGRTHENGOSUB510               :rem 5
270 IF(PEEK(M4)AND32)=ØTHENGOSUB830
                                   :rem 95
280 POKEDD,127:JV=(PEEK(M4)AND2B)/4+(PEEK
    (JS)AND128)/16:POKEDD,255      :rem 98
290 JV=15-(JVAND15):IFJVTHENPOKEX1,BL:X1=
    X1+JY(JV):POKEV1,33:J2=JV      :rem 156
300 IFT1=.THEN:GOSUB720:GOTO750    :rem 163
310 KX=X1:GOSUB800:X1=KX           :rem 242
320 PE=PEEK(X1):ONPE-31GOTO390,390,330,34
    0,350,360,360,370,370,390      :rem 39
330 GOSUB720:GOTO130               :rem 182
340 SC=SC+100:LS=LS+100:T1=TU:GOTO390
                                   :rem 225
350 SC=SC+10:LS=LS+10:T1=TU:GOTO390
                                   :rem 130
360 SC=SC+200:LS=LS+200:T1=TU:GR=U:SF=Ø:G
    C=50-2*LV:GX=M1+M3*RND(U):GOTO390
                                   :rem 14
370 CG=PEEK(X1+C)AND15:IFCG=3THENSC=SC+40
    Ø:LS=LS+400:T1=TU:GR=.:POKEGX,BL:GOTO
    390                            :rem 73
```

A screen crowded with strange creatures in "Things In The Dark," VIC-20 version.

```
380 GOSUB720:GOTO130               :rem 187
390 POKEX1,RO:POKEX1+C,U           :rem 2
400 IFRND(U)<FTHEN190              :rem 248
410 W=RND(U)*M3+M1:PW=PEEK(W):V=INT(RND(U
    )*4)+1:PV=ME%(V,U):PC=ME%(V,TW)
                                   :rem 121
420 IFPW<>BLANDPV<>DITHEN190       :rem 29
430 IFPV=DITHENW=PD-U:PD=W         :rem 209
440 IFPV=DIANDPEEK(W)<>BLTHENW=RND(U)*M3+
    M1:PD=W:GOTO 440               :rem 76
450 POKEW,PV:POKEW+C,PC:GOTO190    :rem 235
460 KX=SX:KX=KX+1:J9=PEEK(KX)      :rem 81
470 IFJ9<>BLANDJ9<>DITHENKX=KX+21:GOSUB80
    Ø:J9=PEEK(KX):IFJ9<>BLANDJ9<>DITHEN49
    Ø                              :rem 52
480 POKESX,BL:SX=KX:GOTO500        :rem 253
490 KX=KX-44:J9=PEEK(KX):IFJ9=DIORJ9=BLTH
    EN480                          :rem 152
500 POKESX,SN:POKESX+C,7:RETURN    :rem 59
510 KX=GX:KX=KX+JY(RND(1)*5):GOSUB800:IFP
    EEK(KX)=BLTHENPOKEGX,BL:GX=KX  :rem 37
520 POKEGX,39:POKEGX+C,3:GC=GC-1   :rem 187
530 IFGC<=.THENGC=.:GR=Ø:POKEGX+C,4
                                   :rem 146
540 RETURN                         :rem 121
550 PRINT"{WHT}{6 SPACES}HIT ANY KEY":WAI
    T19B,1                         :rem 148
560 PRINT"{CLR}{4 DOWN} ADVANCE OR NOT A/
    N ";                           :rem 192
570 GETA$:IFA$<>"A"ANDA$<>"N"THEN570
                                   :rem 29
580 PRINT A$                       :rem 143
590 IFA$="A"THENAD=1               :rem 118
600 IFA$="N"THENAD=Ø               :rem 122
610 PRINT"{3 DOWN} LEVEL 1-6?";    :rem 33
620 GETA$:IFA$<"1"ORA$>"6"THEN620  :rem 65
630 PRINTA$:LV=VAL(A$):PRINT"{CLR}"
                                   :rem 219
640 NM=2:GC$="":JY(1)=-22:JY(2)=22:JY(4)=
    -1:JY(B)=1:X1=7932:JY(3)=Ø:SX=7695
                                   :rem 172
650 JY(5)=-23:JY(6)=21:JY(7)=Ø:JY(9)=-21:
    JY(10)=23:C=3Ø720              :rem 132
660 M1=7790:M2=B163:M3=374:M4=37137:M5=15
    :SN=37:U=1:F=.7:TW=2:DD=37154:POKE371
    39,Ø                           :rem 171
670 JS=37152:POKE36878,15:LC=Ø:BC=Ø:FV=50
    ØØ                             :rem 190
```

"Things In The Dark," IBM PC/PCjr version.

```
680 BL=32:M7=32:RO=33:DI=41:PD=8000:SZ=10
    00                                  :rem 205
690 LS=0:SC=0:GC=0:GR=0:SF=0:RETURN
                                        :rem 179
700 FORA=1TO4:FORB=1TO2:README%(A,B):NEXT
    B,A:RETURN                          :rem 249
710 DATA 34,2,35,5,36,6,41,1            :rem 81
720 NM=NM-1                             :rem 106
730 FORZ1=1TO3:FORZ2=200TO150STEP-1:POKE3
    6874,Z2                             :rem 204
740 NEXTZ2,Z1:POKE36874,0:POKEX1,BL:X1=79
    32:POKEX1,BL:RETURN                 :rem 53
750 PRINT"{HOME}{5 DOWN}{6 RIGHT}{WHT} GA
    ME OVER "                           :rem 222
760 PRINT"{5 RIGHT}{WHT} PLAY AGAIN? "
                                        :rem 217
770 GETA$:IFA$<>"Y"ANDA$<>"N"THEN770
                                        :rem 57
780 IFA$="Y"THEN120                     :rem 47
790 POKE828,0:SYS828                    :rem 168
800 IFKX<M1THENKX=KX+M3                 :rem 225
810 IFKX>M2THENKX=KX-M3                 :rem 231
820 RETURN                              :rem 122
830 WAITM4,M7,0:WAITM4,M7,32:RETURN
                                        :rem 168
```

Program 5: Things In The Dark For PC/PCjr

Version by Kevin Mykytyn, Editorial Programmer
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
BG 10 DEFINT A-L:DEF SEG=0:POKE 1047,(PEEK
      (1047)AND 223) OR  64:DEF SEG
PE 20 KEY OFF:SCREEN 1,0:CLS:CIRCLE (50,50
      ),50,,,,1
EN 30 PAINT (50,50),3:LOCATE 10,25:PRINT "
      THINGS":LOCATE 13,27:PRINT "IN":LOCA
      TE 16,24:PRINT "THE DARK"
BG 40  PLAY "MB T64  O3 L8 CBA# O2DFL7F# O
      1 G"
LE 50 FOR N=1 TO 15:A=INT(RND(1)*26)+16:B=
      INT(RND(1)*8)+1:LOCATE B,A:PRINT "."
      :FOR TD=1 TO 200:NEXT:NEXT:FOR TD=1
      TO 1000:NEXT
OK 60 DEF SEG:GOSUB 310:GOSUB 380:GOSUB 43
      0:CLS
JO 65 CLS:PX=20:PY=12
NL 70 DEF SEG = 0:POKE 1050,PEEK(1052):DEF
       SEG:FL=0:LOCATE PY,PX:PRINT BL$;:NM
      =NM-1:IF NM=<0 THEN LOCATE 1,24:PRIN
      T "              ":GOTO 690
IK 80 LOCATE PY,PX:PRINT BL$;:DEF SEG :POK
      E DS,3:LOCATE 1,1:PRINT "GC:":LOCATE
       3,1:PRINT "SCORE:":LOCATE 3,27:PRIN
      T "T:":LOCATE 1,16:PRINT"LV:"LV
KP 90 LOCATE 1,24:PRINT "              ":PX=20
      :PY=12:PPX=20:PPY=12:N=0:FOR A=1 TO
      NM-1:LOCATE 1,30-A:DEF SEG:POKE DS,3
      :PRINT CHR$(128):NEXT:TU=55-6*LV:T1=
      TU
KO 100 LOCATE 5,1:PRINT"_____
      _____"
FA 110 T1=T1-N1:DEF SEG:POKE DS,1:LOCATE 3
      ,8:PRINT SC:LOCATE 3,31:PRINT T1:LO
      CATE 1,4:PRINT GC:GOSUB 160:GOSUB 2
      20:IF FL=1 THEN GOSUB 740:GOTO 70 E
      LSE IF T1=0 THEN NM=0:GOTO 70
PF 120 IF SC=>SNSC THEN SF=1:SNSC=SNSC+100
      0:LOCATE  SY,SX :PRINT BL$;:SX=N1:S
      Y=INT(RND(N1)*N7+N10):LOCATE GX,GY:
      PRINT BL$:GR=0
KJ 130 IF SF THEN GOSUB 665
PK 140 IF GR THEN GOSUB 630
PH 147 IF SC>=EXMSC THEN NM=NM+1:EXMSC=EXM
      SC+2500
AD 150 IF SC>HSCL THEN HSCL=HSCL+5000:LV=L
      V+1:GOTO 80:ELSE 110
LI 160 N$=INKEY$:IF N$="" THEN 170 ELSE N=
      ABS(ASC(RIGHT$(N$,N1))-71)
KE 170 ON N GOSUB 180,180,190,190,200,200,
      210,210,210:TY=PY:TX=PX:GOSUB 710:P
      Y=TY:PX=TX:RETURN
PH 180 PY=PY-N1:RETURN
PK 190 PX=PX-N1:RETURN
MF 200 PX=PX+N1:RETURN
NG 210 PY=PY+N1:RETURN
QJ 220 PE=SCREEN(PY,PX):IF PE THEN ON PE-N
      128 GOTO 240,250,260,270,270,280,24
      0
HA 230 GOTO 290
KJ 240 FL=1:GOTO 290
KE 250 SC=SC+N100:LS=LS+N100:T1=TU:GOTO 29
      0
CB 260 SC=SC+N10:LS=LS+N10:T1=TU:GOTO 290
LH 270 SC=SC+N200:LS=LS+N200:T1=TU:GR=N1:S
      F=0:GC=N50-N6*LV:CG=N3:GX=RND(N10)+
      N10:GY=GX:IF SF THEN SF=0:LOCATE SX
      ,SY:PRINT BL$:GOTO 290:ELSE 290
EA 280 SC=SC+N400:LS=LS+N400:T1=TU:GR=0!:L
      OCATE GX,GY:PRINT BL$;:GOTO 290 ELS
      E GOSUB 530:GOTO 70
EI 290 LOCATE PPY,PPX:PRINT BL$;:LOCATE PY
      ,PX:DEF SEG:POKE DS,N3:PRINT RO$;:P
      PX=PX:PPY=PY
GI 300 IF RND(N1)>NP4 THEN RETURN ELSE X=I
      NT(RND(N1)*N18)+N6:Y=INT(RND(N1)*N4
      0)+N1:IF SCREEN(X,Y) THEN RETURN EL
      SE C=INT(RND(N1)*N4)+N1:LOCATE X,Y:
      DEF SEG:POKE DS,A(C,N2):PRINT CHR$(
      A(C,N1));:RETURN
QI 310 REM
EC 320 DEF SEG=&H1700:FOR DOTPOS =0 TO 79:
      READ DOTDATA:POKE DOTPOS,DOTDATA:NE
      XT
IL 330 DEF SEG=0
JG 340 FOR VECTOR=0 TO 2:POKE (&H7C+VECTOR
      ),0:NEXT:POKE &H7F,&H17
NH 350 RETURN
PL 360 DATA 24,36,24,126,90,90,24,60,126,1
      53,255,195,90,126,36,102,126,90,126
      ,255,24,60,36,102,24,36,24,60,126,6
      0,66,195
JO 370 DATA 0,0,12,190,245,67,0,0,0,0,48,1
      21,175,194,0,0,66,126,90,60,231,129
```

```
      ,195,0,66,126,90,60,255,129,195,0,6
      5,93,42,28,42,73,20,54,0,0,0,0,255,
      0,0,0
NB 380 REM set up variables
HK 390 FOR A=1 TO 4:FOR B=1 TO 2:READ A(A,
      B):NEXT B,A
CH 400 DATA 129,3,130,1,131,1,136,2
MA 410 DS=&H4E:N1=1:N2=2:N3=3:N4=4:N5=5:N6
      =6:N7=7:N25=25:N40=40:NP4=.4:RO$=CH
      R$(128):BL$=CHR$(32):N10=10:N100=10
      0:N200=200:N400=400:N50=50:NM=3:CG=
      3:N18=18:N128=128:HSCL=5000:GR$=CHR
      $(134):SC=0:DX=1:SNSC=1000:SF=0:GR=
      0:SN$=CHR$(132):GC=0
CI 420 N23=23:EXMSC=2500:SX=20:SY=20:GX=12
      :GY=12:RETURN
LJ 430 CLS:PRINT:PRINT "          Land the
      robot "CHR$(128)" on the "
FF 440 PRINT:PRINT "          Gramlins    "
      CHR$(131)".. 10  pts"
GK 450 PRINT:PRINT "          Blockheads "
      CHR$(130)".. 100 pts"
BI 460 PRINT:PRINT "          Snakes      "
      CHR$(132)".. 200 pts"
DE 470 PRINT:PRINT "          Blue Graps "
      CHR$(134)".. 400 pts"
MN 480 PRINT:PRINT:PRINT"   Avoid the norf
      s ";CHR$(129);" and the purple"
OI 490 PRINT"   graps   A dinit "CHR$(136)
      " is not worth any ":PRINT "   poin
      ts but a norf cannot land on a
       dinit."
KF 500 PRINT:PRINT "          Hit any key t
      o continue"
EO 510 N$=INKEY$:IF N$="" THEN 510
BH 520 CLS:PRINT:PRINT "   You must score
      before the turn          counter T:
       reaches 0. The graps          remai
      n blua until the grap counter
      GC: reachas 0."
CH 530 PRINT:PRINT "   You earn one chance
       at a snake          every 1000 poi
      nts and at a grap          every sna
      ke."
JH 540 PRINT:PRINT "        Use cursor keys
       to move.
LH 550 PRINT:PRINT "          Hit any kay t
      o start"
CJ 560 N$=INKEY$:IF N$=""THEN 560
HD 570 CLS:LOCATE 4,8:PRINT "ADVANCE OR NO
       ADVANCE A/N"
CH 580 N$=INKEY$:IF N$="A" THEN AD=1 ELSE
      IF N$="N" THEN AD=0 ELSE 580
AE 590 LOCATE 6,5:PRINT "LEVEL ? (1-6) 1 I
      S THE EASIEST"
OO 600 N$=INKEY$:IF N$<"1" OR N$>"6" THEN
      600 ELSE LV=VAL(N$)
MC 610 RETURN
PP 620 DEF SEG=0:FOR VECTOR=0 TO 3:POKE (&
      H7C+VECTOR),OLDVEC(VECTOR):NEXT
LA 630 TY=GX:TX=GY:TY=TX+SGN(RND(N1)*N2-N1
      ):TY=TY+SGN(RND(N1)*N2-N1):GOSUB 71
      0:PG=SCREEN(TY,TX):IF PG THEN 640 E
      LSE LOCATE GX,GY:PRINT BL$;:GX=TY:G
      Y=TX
MP 640 LOCATE GX,GY:DEF SEG:POKE DS,N1:PRI
      NT GR$;
JH 650 GC=GC-1:IF GC<0 THEN GR=0:GC=0:LOCA
      TE GX,GY:DEF SEG:POKE DS,N2:PRINT C
      HR$(135);
NN 660 RETURN
DO 665 TX=SX:TY=SY:TX=TX+N1:IF TX<1 OR TX>
      40 THEN TY=TY+1
AO 670 GOSUB 710:SP=SCREEN(TY,TX):IF SP TH
      EN TY=TY+1:TX=TX-1:GOSUB 710:SP=SCR
      EEN(TY,TX):IF SP THEN TY=TY-2:GOSUB
       710:SP=SCREEN(TY,TX):IF SP THEN 68
      0
CM 675 LOCATE SY,SX:PRINT BL$;:SX=TX:SY=TY
KI 680 LOCATE SY,SX:PRINT SN$;:RETURN
MF 690 DEF SEG:POKE DS,3:LOCATE 4,15:PRINT
       "PLAY AGAIN?"
HF 700 N$=INKEY$:IF N$="Y" THEN GOSUB 570:
      GOSUB 410:CLS:GOTO 70:ELSE IF N$="N
      " THEN CLS:ENO:ELSE 700
GA 710 IF TX<N1 THEN TX=N40:TY=TY+N1:ELSE
      IF TX>N40 THEN TX=N1:TY=TY+N1
DA 720 IF TY<N6 THEN TY=N23 ELSE IF TY>N23
       THEN TY=N6
MH 730 RETURN
NI 740 FOR A=1 TO 3:FOR B=90 TO 40 STEP -1
      :SOUND B,.2:NEXT B,A:RETURN
```

Program 6: Things In The Dark For Apple

Version by Rob Terrell, Programming Assistant
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10  HIMEM: 141 * 256
20  GOTO 730
30 NK = 1000:MN = 1:MS = 2500:SC = 0:LV
     = 1:LH = 1:SF = 0:GF = 0
40 RH = 20:RV = 12: GOSUB 1450:SH = 1:S
     V = 12:GV = 10:GH = 40:NL = 5000
50  GOTO 220
60 NM =  SCRN( X,2 * Y) + 18 *  SCRN( X
     ,2 * Y + 1):NM = NM - 128
70  RETURN
80  VTAB 21: HTAB 1: PRINT "GRAP: "GC; TAB(
     28);"ROBOTS: "MN"  ": PRINT "SCORE
     : "SC; TAB( 28);"TIME: "TC"  ": PRINT
     "LEVEL: "LE" ";
90  RETURN
100 TC = TC - (I / 2 =  INT (I / 2))
110 I = I + 1: IF  PEEK ( - 18384) < 12
     8 THEN 130
120  GET A$:K =  ASC (A$)
130 LH = RH:LV = RV
140 RV = RV + (K = 75) - (K = 73) + (RV
      = 1 AND K = 73) * 20 - (RV = 20 AND
     K = 75) * 20
150 RH = RH + (K = 78) - (K = 74) + (RH
      = 1 AND K = 74) * 40 - (RH = 40 AND
     K = 78) * 40
160 X = RH - 1:Y = RV - 1: GOSUB 60
170  IF NM = 32 THEN 220
180  IF NM = 35 OR NM = 38 THEN SC = SC
      + 10 + (NM = 35) * 90: GOSUB 1450
     : GOSUB 80: GOTO 220
190  IF NM = 37 OR NM = 94 THEN SC = SC
      + 200:SF = 0:GF = 1:GC = 70 - LE *
     10:GC = (GC = 10) * 10 + GC: GOSUB
     1450:SH = 1:SV = 12:GH = 40:GV = 1
     0: GOSUB 80: GOTO 220
200  IF NM = 39 THEN SC = SC + 400: GOSUB
     1450:GF = 0: GOSUB 80: GOTO 220
210  IF NM = 47 OR NM = 84 THEN 850
220  HTAB LH: VTAB LV: PRINT " "
230  POKE  - 16336,0: POKE  - 16338,0
240  HTAB RH: VTAB RV: PRINT "!"
250 L = 18 - LE:HO =  INT ( RND (8) * L
     ) + 1
260  IF SF THEN 470
270  IF TC =  - 1 THEN 890
280  IF GF THEN 570
290  IF TC < 20 THEN S =  PEEK ( - 1633
     6)
```

```
300  GOSUB 60
310  IF HO = 5 OR HO = 6 OR HD >  = 8 THEN
     100
320  IF HO = 3 THEN PC$ = "@"
330  IF HO = 4 THEN PC$ = "$"
340  IF HO = 1 OR HO = 2 AND LE > 3 THEN
     PC$ = "@"
350  IF HO = 7 THEN 430
3B0 TH =  INT ( RND (5) * 40) + 1:TV =
      INT ( RND (5) * 20) + 1
370 X = TH - 1:Y = TV - 1: GOSUB 60: IF
     NM <  > 32 THEN TH = TH + (TH <  >
     40):TV = TV + 2 * (TV < 19)
3B0  HTAB TH: VTAB TV: PRINT PC$
390  IF SC =  > NK AND  NOT SF THEN NK =
     NK + 1000: IF  NOT GF THEN SF = 1
400  IF SC >  = MS THEN MS = MS + 2500:
     MN = MN + 1: GOSUB 60
410  IF SC > NL AND AF THEN NL = NL + 5
     000:LE = LE + (LE < 6)
420  GOTO 100
430 DX = DX - 1 + (DX = 1) * 40:DY = DY
     - (DX = 0) + (DX = 0) * (DY = 1) *
     20
440 X = DX - 1:Y = DY - 1: GOSUB 60: IF
     NM = 32 THEN 460
450 DX =  INT ( RND (4) * 39) + 1:DY =
      INT ( RND (4) * 19) + 1:X = DX -
     1:Y = DY - 1: GOSUB 60: IF NM <  >
     32 THEN 100
460  HTAB DX: VTAB DY: PRINT "*": GOTO
     100
470  HTAB SH: VTAB SV: PRINT " "
4B0 SH = SH + 1:X = SH - 1:Y = SV - 1:
    GOSUB 60: IF NM = 32 OR NM = 42 THEN 540
490 SV = SV + 1:Y = SV - 1: GOSUB 60: IF
     NM = 32 OR NM = 42 THEN 540
500 SV = SV - 2:Y = SV - 1
510  IF SV < 1 THEN SV = 20:Y = SV - 1
520  GOSUB 60: IF NM = 32 OR NM = 42 THEN
     540
530  GOTO 550
540 SH = SH + (SH < 1) * 40 - (SH > 40)
     * 40:SV = SV + (SV < 1) * 20 - (S
     V > 20) * 20
550  HTAB SH: VTAB SV: IF PS$ = "^" THEN
     PS$ = "%": PRINT PS$: GOTO 270
560 PS$ = "^": PRINT PS$: GOTO 270
570  HTAB GH: VTAB GV: PRINT " "
580 GD =  INT ( RND (6) * 4):GH = GH +
     (GD = 0) - (GH = 40 AND GD = 0) *
     40 - (GO = 1) + (GH = 1 AND GD = 1
     ) * 40
590 GV = GV - (GO = 2) + (GV = 1 AND GD
     = 2) * 20 + (GD = 3) - (GV = 20 AND
     GD = 3) * 20
600 X = GH - 1:Y = GV - 1: GOSUB 60: IF
     NM <  > 32 THEN 560
610 GP$ = "'"
620 GC = GC - 1: IF GC <  = 0 THEN GP$ =
     "/":GF = 0
630  HTAB GH: VTAB GV: PRINT GP$
640  GOTO 290
650  FOR J = 1 TO 3: FOR I = 1 TO 4: FOR
     Z = 1 TO 3: POKE  - 16336,0: POKE
      - 16336,0: NEXT Z: POKE  - 16336,
     0: NEXT I: POKE  - 16336,0: POKE  -
     16336,0: POKE  - 16336,0: FOR Z =
     1 TO 9:S =  PEEK ( - 16336): FOR W
      = 1 TO 10: NEXT W: NEXT Z: NEXT J
660  GOSUB 1450: IF GF THEN  HTAB GH: VTAB
     GV: PRINT " "
670  HTAB RH: VTAB RV: PRINT " ": VTAB
     LV: HTAB LH: PRINT " "
6B0  IF MN > 0 THEN MN = MN - 1:RH = 20
     :RV = 12:K = 0: GOTO 220
690  VTAB 24: HTAB 1: PRINT "GAME OVER.
      PLAY AGAIN? (Y/N) ";: GET A$: IF
     A$ <  > "Y" AND A$ <  > "N" THEN 6
     90
700  IF A$ = "Y" THEN  GOSUB 940:K = 0:
      GOTO 30
710  TEXT : HOME : END
720  REM  INTRODUCTION
730  HOME : VTAB 6: PRINT ,"THINGS": PRINT
     : PRINT ,"IN THE": PRINT : PRINT ,
     " DARK": VTAB 12: PRINT  SPC( 14):
      INVERSE : VTAB 21: PRINT "PLEASE
     WAIT": NORMAL
740  GOSUB 990
750  GOSUB 1120
760 DY =  INT ( RND (5) * 19) + 1:DX =
      INT ( RND (5) * 39) + 1
770  HOME : HGR : POKE 6,0: POKE 7,141:
      POKE 54,0: POKE 55,3: CALL 1002
760  GOSUB 790: GOTO 30
790  TEXT : HGR : PRINT "INSTRUCTIONS..
     ."
600  PRINT "MOVE AROUND THE SCREEN USIN
     G THE I-J-K-LKEYS. ANY OTHER KEY P
     AUSES ACTION."
610  HTAB 20: VTAB 12: PRINT "!": HTAB
     1: GOSUB 1430: VTAB 24: PRINT : PRINT
     : PRINT : PRINT
620  VTAB 22: PRINT "RUN INTO A GREMLIN
      ... 10 PTS."
630  GOSUB 1420: PRINT "$": GOSUB 1430
640  PRINT " BLOCKHEAO ...100 PTS."
650  GOSUB 1420: PRINT "#": GOSUB 1430
660  PRINT " SNAKE      ...200 PTS."
670  GOSUB 1420: PRINT "%": GOSUB 1430
660  PRINT " GOOD GRAP ...400 PTS."
B90  GOSUB 1420: PRINT "'": GOSUB 1430
900  VTAB 24: HTAB 1: PRINT "DO NOT RUN
      INTO A NORF OR A BAD GRAP"
910  PRINT "OR YOU WILL BE ZAPPED OUT O
     F EXISTENCE!": PRINT
920  GOSUB 1420: PRINT "@": VTAB 14: HTAB
     20: PRINT "/": GOSUB 1430
930  HTAB 1: VTAB 24: PRINT : PRINT
940  PRINT : PRINT : PRINT : PRINT : VTAB
     21: PRINT "(A)DVANCE/(N)O ADVANCE:
      ";: GET A$:AF = (A$ = "A")
950  HTAB 1: PRINT : PRINT
960  PRINT "STARTING LEVEL (1-6): ";: GET
     LE$:LE =  VAL (LE$): IF LE > 6 OR
     LE < 1 THEN  VTAB 24: GOTO 950
970  HOME : HGR
960  RETURN
990 X = 0: FOR I = 766 TO 652: READ A:X
     = X + A: POKE I,A: NEXT : IF X <
     > 7734 THEN  PRINT "ERROR IN 1ST
     SET OF DATA STATEMENTS.": STOP
1000  DATA  133,69,134,70,132,71,166,7
1010  DATA  10,10,176,4,16,62,46,4
1020  DATA  16,1,232,232,10,134,27,24
1030  DATA  101,6,133,26,144,2,230,27
1040  DATA  165,40,133,8,165,41,41,3
1050  DATA  5,230,133,9,162,8,160,0
1060  DATA  177,26,36,50,48,2,73,127
1070  DATA  164,36,145,8,230,26,206,2
1060  DATA  230,27,165,9,24,105,4,133
```

```
1090  DATA  9,202,208,226,165,69,166,70
1100  DATA   164,71,78,240,253
1110  RETURN
1120 X = 0: FOR I = 36096 TO 38863
1130  READ A:X = X + A
1140  IF A < 0 THEN B = A *  - 1: FOR Z
      = I TO I + 1: POKE Z,0: NEXT Z:I =
     I + B: NEXT I
1150  IF I =  > 38884 THEN 1400
1160  POKE I,A: NEXT I
1170  DATA   0,0,0,0,0,0
1180  DATA  0,0,28,62,28,8,127,8
1190  DATA  28,20,0,0,0,0,0,0
1200  DATA  0,0,62,42,62,8,8,28
1210  DATA  62,34,8,28,42,62,8,28
1220  DATA  54,99,0,0,0,51,76,0
1230  DATA  0,0,0,0,0,0,0,0
1240  DATA  0,0,82,28,8,28,62,99
1250  DATA  65,85,0,0,0,0,0,0
1260  DATA  0,0,0,0,0,0,0,0
1270  DATA  0,0,65,34,20,127,8,28
1280  DATA  34,99,0,0,0,0,0,0
1290  DATA  0,0,0,0,0,0,0,0
1300  DATA  0,0,0,0,0,0,0,0
1310  DATA  0,0,0,0,0,0,0,0
1320  DATA  0,0,65,65,99,62,28,8
1330  DATA  28,62,0,0,0,0,0,0
1340  DATA  -120
1350  DATA     0,28,127,93,119,2 0,28
1360  DATA  127,99,0,0,0,0,0,0
1370  DATA  -224
1380  DATA  0,0,0,0,76,51
1390  DATA   -300
1400  IF X <  > 2444 THEN  PRINT "ERROR
      IN 2ND SET OF DATA STATEMENTS.":
      STOP
1410  RETURN
1420  HTAB 20: VTAB 12: RETURN
1430  VTAB 24: PRINT "PRESS ANY KEY TO
     CONTINUE";
1440  WAIT  - 18384,128: POKE  - 16388,
     0: VTAB 22: HTAB 11: RETURN
1450 TC = 70 - LE * 10: RETURN
```

Program 7: Things In The Dark For TI

Version by Patrick Parrish, Programming Supervisor
Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 GOSUB 1200
110 GOSUB 710
120 GOSUB 1030
130 GOSUB 1800
140 GOTO 190
150 FOR I=1 TO LEN(H$)
160 CALL HCHAR(R,C+I,ASC(SEG$(H$,I,
     1)))
170 NEXT I
180 RETURN
190 CALL CLEAR
200 PRINT TAB(2);"GC=0";TAB(23);CHR
     $(136)::
210 PRINT TAB(2);"SC=0";TAB(13);"L=
     ";STR$(LV);TAB(23);"T=";STR$(TM
     -(LV-1)*10)
220 PRINT ::::::::::::::::::::
230 CALL HCHAR(4,1,126,32)
240 RANDOMIZE
250 FOR I=1 TO 5
260 R=INT(RND*20)+5
270 C=INT(RND*31)+1
280 IF (R=13)*(C=16)THEN 260
```

"Things In The Dark," Apple version.

```
290 CALL HCHAR(R,C,G(RND*3))
300 NEXT I
310 CALL HCHAR(RR,RC,G(7))
320 OLDRC=RC
330 OLDRR=RR
340 H$=STR$(T)&" "
350 R=3
360 C=26
370 GOSUB 150
380 IF T=0 THEN 2350
390 CALL KEY(0,K,S)
400 IF K=80 THEN 2720
410 IF (K<>68)*(K<>69)*(K<>83)*(K<>
     88)THEN 440
420 DX=(K=83)-(K=68)
430 DY=(K=69)-(K=88)
440 RR=RR+DY+(RR=5)*20*(DY=-1)-(RR=
     24)*20*(DY=1)
450 RC=RC+DX+(RC=1)*31*(DX=-1)-(RC=
     31)*30*(DX=1)
460 CALL HCHAR(OLDRR,OLDRC,32)
470 CALL GCHAR(RR,RC,L)
480 IF L=32 THEN 540
490 FOR I=0 TO 6
500 IF L<>G(I)THEN 530
510 ON I+1 GOTO 1920,1950,2010,2070
     ,2190,2280,2070
520 I=6
530 NEXT I
540 CALL HCHAR(RR,RC,G(7))
550 IF GC=0 THEN 640
560 GC=GC-1
570 R=1
580 C=6
590 H$=STR$(GC)&" "
600 GOSUB 150
810 IF (GC<>0)+(GF=0)THEN 640
620 CALL HCHAR(SNR,SNC,G(6))
630 GF=0
640 T=T-1
650 R=RND*19+5
660 C=RND*30+1
670 CALL GCHAR(R,C,L)
680 IF (L<>32)+(RND*3<1)THEN 320
690 CALL HCHAR(R,C,G(RND*3))
700 GOTO 320
710 CALL CLEAR
720 CALL SCREEN(2)
730 PRINT TAB(2);"PPPPP"
```

"Things In The Dark" on the TI-99/4A.

```
740 PRINT TAB(4);"p[3 SPACES]p   p p
    p   p rppq rpq"
750 PRINT TAB(4);"p[3 SPACES]p   p p
    pq p p[4 SPACES]p"
760 PRINT TAB(4);"p[3 SPACES]pppp p
    psqp p rq spq"
770 PRINT TAB(4);"p[3 SPACES]p   p p
    p sp p   p[3 SPACES]p"
780 PRINT TAB(4);"p[3 SPACES]p   p p
    p   p sppt spt":::
790 PRINT TAB(8);"I N[3 SPACES]T H
    E":::
800 PRINT TAB(9);"pppq rppq pppq p
    r"
810 PRINT TAB(9);"p   p p   p p   p p
    rt"
820 PRINT TAB(9);"p   p p   p p   t pr
    t"
830 PRINT TAB(9);"p   p pppp pppq ps
    q"
840 PRINT TAB(9);"pppt p   p p   p p
    sq":::
850 GOSUB 2740
860 CALL CLEAR
870 FOR I=3 TO 8
880 CALL COLOR(I,16,2)
890 NEXT I
900 PRINT "LAND THE ROBOT.. ";CHR$(
    136);" ON GREM-","LINS.. ";CHR$
    (128);" 10 PTS, BLOCKHEADS"
910 PRINT "x 100 PTS, SNAKES.. ";CH
    R$(125);" 200","PTS, CYAN GRAPS
    .. ";CHR$(106);" 400 PTS.",,
920 PRINT "AVOID THE NORFS.. ";CHR$
    (117);". BOTH","THE ROBOT AND T
    HE NORF"
930 PRINT "DISAPPEAR WHEN THEY TOUC
    H.","TOUCHING A RED GRAP IS LIK
    E"
940 PRINT "TOUCHING A NORF. DINITS.
    .";
950 PRINT CHR$(99);"REPEL NORFS.":
960 PRINT "YOU MUST SCORE BEFORE TH
    E","TURN COUNTER T REACHES 0."
970 PRINT "THE GRAPS REMAIN CYAN UN
    TIL","THE GRAP COUNTER GC REACH
    ES","0. YOU EARN ONE CHANCE AT A"
980 PRINT "SNAKE EVERY 1000 PTS AND
     AT","A GRAP EVERY SNAKE. PRESS
    P","TO PAUSE THE ACTION, R TO"
    ,"RESTART.",,,
990 PRINT TAB(2);"PRESS ANY KEY TO
    CONTINUE"
1000 CALL KEY(0,K,S)
1010 IF S=0 THEN 1000
1020 RETURN
1030 CALL CLEAR
1040 PRINT "ADVANCE (A)/NO ADVANCE
     (N) ";
1050 CALL KEY(0,K,S)
1060 IF S=0 THEN 1050
1070 IF (K<>65)*(K<>78)THEN 1050
1080 PRINT CHR$(K)
1090 AD=-(K=65)
1100 PRINT ::::::
1110 PRINT " LEVEL 1-6 (1 IS EASIES
     T) ";
1120 CALL KEY(0,K,S)
1130 IF S=0 THEN 1120
1140 IF (K<49)+(K>54)THEN 1120
1150 PRINT CHR$(K)
1160 LV=K-48
1170 T=60-(LV-1)*10
1180 RETURN
1190 REM  REDEFINE CHARACTERS
1200 CALL CLEAR
1210 PRINT TAB(9);"PLEASE WAIT..."
1220 FOR I=112 TO 116
1230 READ A$
1240 CALL CHAR(I,A$)
1250 NEXT I
1260 FOR I=1 TO 9
1270 READ A,A$
1280 CALL CHAR(A,A$)
1290 NEXT I
1300 FOR I=5 TO 7
1310 CALL COLOR(I,9,2)
1320 NEXT I
1330 CALL COLOR(2,16,2)
1340 FOR I=9 TO 14
1350 READ A,B
1360 CALL COLOR(I,A,B)
1370 NEXT I
1380 DATA FFFFFFFFFFFFFFFF,80C0E0F0
     F8FCFEFF,0103070F1F3F7FFF
1390 DATA FF7F3F1F0F070301,FFFEFCF8
     F0E0C080
1400 DATA 99,415D2A1C2A491436,106,4
     27E5A3CE781C300,117,7E99FFC35A
     7E2466
1410 DATA 118,427E5A3CE781C300,120,
     7E5A7EFF183C2466
1420 DATA 125,00003079AFC20000,126,
     000000FFFF000000
1430 DATA 128,1824183C7E3C42C3,136,
     1824187E5A5A183C
1440 DATA 4,2,8,2,9,2,11,2,13,2,15,2
1450 FOR I=0 TO 7
1460 READ A
1470 G(I)=A
1480 NEXT I
1490 REM  CHAR$ & POINT VALUE DATA
1500 DATA 99,128,120,117,106,125,11
     8,136
1510 FOR I=0 TO 6
1520 READ PT(I)
1530 NEXT I
1540 DATA 0,10,100,0,400,200,0
1550 DIM VOC1(96),VOC2(96)
1560 FOR I=1 TO 96
```

```
1570 READ VOC1(I)
1580 IF VOC1(I)<>0 THEN 1600
1590 VOC1(I)=40000
1600 NEXT I
1610 FOR I=1 TO 98
1620 READ VOC2(I)
1630 IF VOC2(I)<>0 THEN 1650
1640 VOC2(I)=40000
1650 NEXT I
1660 REM  MUSIC DATA
1670 DATA 175,0,262,0,262,0,175,0,2
     62,0,262,0,175,0
1680 DATA 262,0,262,0,175,0,262,0,2
     62,0
1690 DATA 131,0,262,0,262,0,131,0,2
     82,0,262,0,131,0,262,0,262,0,1
     31,0
1700 DATA 262,0,262,0,175,0,262,0,2
     62,0,175,0,262,0,262,0
1710 DATA 175,0,262,0,262,0,175,0,2
     62,0,262,0,131,0,262,0
1720 DATA 262,0,131,0,262,0,262,0,1
     75,175,175,175,175,175,175,175
     ,175,175,175,175
1730 DATA 415,0,0,0,0,0,466,0,0,0,0
     ,0
1740 DATA 523,554,523,554,523,554,5
     23,0,0,0,0,0
1750 DATA 392,0,0,0,0,0,415,0,0,0,0
     ,0
1760 DATA 466,523,466,523,466,523,4
     66,0,0,0,0,0,415,0,0,0,0,0
1770 DATA 466,0,0,0,0,0,523,554,523
     ,554,523,554,523,0,0,0,0,0
1780 DATA 392,0,415,0,466,0,523,523
     ,523,523,466,466,415,415,415,4
     15,415,415,415,415,415,415,415
     ,415
1790 RETURN
1800 TM=60
1810 SC=0
1820 RR=13
1830 RC=16
1840 NR=2
1850 AR=0
1860 GR=0
1870 SF=0
1880 GF=0
1890 DX=1
1900 RETURN
1910 REM  DENIT
1920 CALL SOUND(100,110,2)
1930 GOTO 520
1940 REM  GREMLIN
1950 FOR J=0 TO 30 STEP 5
1960 CALL SOUND(100,392,J)
1970 NEXT J
1980 GOSUB 2440
1990 GOTO 520
2000 REM  BLOCKHEAD
2010 FOR J=30 TO 0 STEP -10
2020 CALL SOUND(100,294,J)
2030 NEXT J
2040 GOSUB 2440
2050 GOTO 520
2060 REM  NORF & RED GRAP
2070 CALL SOUND(150,-3,2)
2080 NR=NR-1
2090 CALL HCHAR(RR,RC,32)
2100 T=TM-(LV-1)*10+1
2110 IF NR=0 THEN 2350
2120 CALL HCHAR(1,25,32)
2130 RR=13
2140 RC=16
2150 DX=1
2160 CALL HCHAR(13,17,32)
2170 GOTO 520
2180 REM  CYAN GRAP
2190 FOR J=0 TO 30 STEP 5
2200 CALL SOUND(100,1175,J,-3,J)
2210 NEXT J
2220 GF=0
2230 SF=0
2240 GOSUB 2440
2250 GC=1
2260 GOTO 520
2270 REM  SNAKE
2280 FOR J=0 TO 30 STEP 5
2290 CALL SOUND(100,4000,J)
2300 NEXT J
2310 SF=0
2320 GF=-1
2330 GOSUB 2440
2340 GOTO 520
2350 REM  END OF GAME SOUND
2360 H$="PLAY AGAIN (Y/N)?"
2370 R=2
2380 C=8
2390 GOSUB 150
2400 CALL KEY(0,K,S)
2410 IF (K<>78)*(K<>89)THEN 2400
2420 IF K=89 THEN 120
2430 STOP
2440 R=3
2450 C=6
2460 SC=SC+PT(I)
2470 GR=GR+PT(I)
2480 AR=AR+PT(I)
2490 H$=STR$(SC)
2500 FOR J=1 TO LEN(H$)
2510 CALL HCHAR(R,C+J,ASC(SEG$(H$,J
     ,1)))
2520 NEXT J
2530 IF (GR<1000)+((GR>=1000)*((SF=
     1)+(GF=1)))THEN 2700
2540 IF GF=-1 THEN 2580
2550 I=5
2560 SF=1
2570 GOTO 2620
2580 I=4
2590 GF=1
2600 GC=21
2610 GR=GR-1000
2620 SNR=RND*19+5
2630 SNC=RND*30+1
2640 CALL GCHAR(SNR,SNC,L)
2650 IF L<>32 THEN 2620
2660 CALL HCHAR(SNR,SNC,G(I))
2670 IF AR<5000 THEN 2700
2680 AR=AR-5000
2690 LV=LV+1+(LV>5)
2700 T=TM-(LV-1)*10+1
2710 RETURN
2720 CALL KEY(0,K,S)
2730 IF K<>82 THEN 2720 ELSE 410
2740 FOR I=1 TO 96
2750 CALL SOUND(100,VOC1(I),2,VOC2(
     I),2)
2760 NEXT I
2770 RETURN
```

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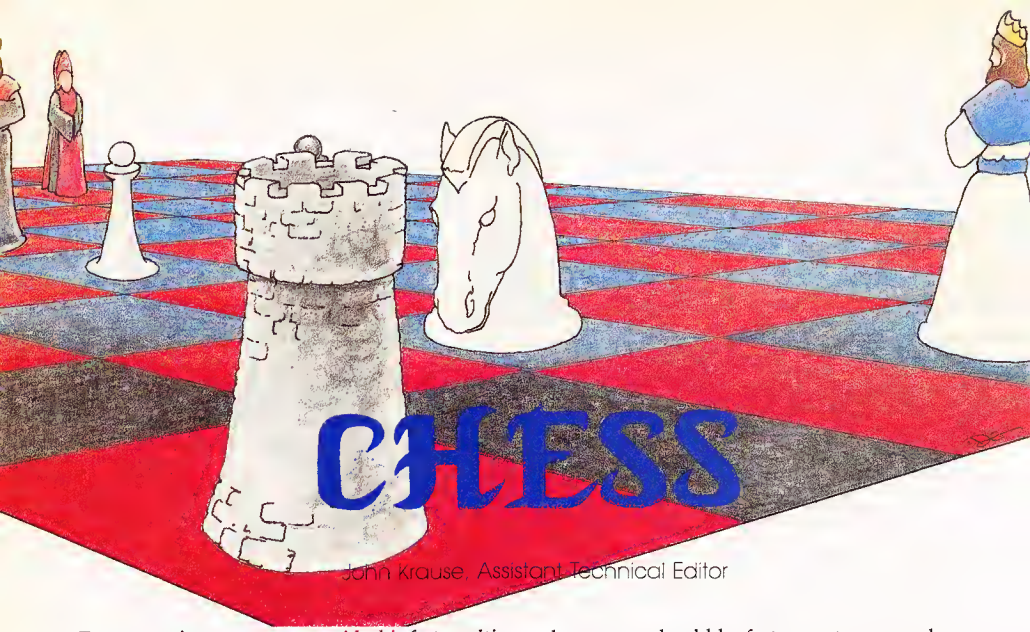

CHESS

John Krause, Assistant Technical Editor

Try to outwit your computer with this fast, multi-level chess program whose intelligence routines are written entirely in machine language. There are versions for the Commodore 64; VIC-20 with at least 8K memory expansion; Ataris with at least 32K RAM; and Apples with at least 48K RAM and a disk drive. All versions except Apple require a joystick.

The world was amazed, in the late eighteenth century, by a machine that had the astonishing ability to play a good game of chess. It entertained kings and queens. It defeated Napoleon, a master tactician. Hundreds of people paid to compete against it, but eventually it was revealed that a small man was hidden inside the machine.

A chess-playing machine remained only a dream until the late 1950s when the first computer chess game was played. Now, the World Computer Championship, held every three years since 1974, attracts almost as much publicity as the human championship matches. Why has there been so much interest in machines that play games?

One reason is that chess can be used to measure a computer's intelligence. Chess is easy to play, but difficult to master. So difficult, in fact, that some experts believe that a computer would have to be almost as intelligent as a human to become world champion.

Of course, another reason is that chess is just plain fun, but not if you can't find an opponent. To be an entertaining opponent, a computer chess game should be fast, easy to use, and capable of playing at several different skill levels. "Chess" has all these features and more. Although it's really no match against the best commercial chess games, it *has* managed to defeat these giants of the microcomputer chess world on rare occasions.

Typing It In

The VIC and 64 versions are in two parts. 64 users should type in Program 1 and save it. Then enter NEW, type in Program 2 and save it with the name CHESS2. The VIC version needs at least 8K of expansion memory. VIC users should substitute the following lines into Program 1 before saving, and then enter NEW, type in Program 3 and save it with the name CHESS2.

```
5 POKE56,60:POKE55,0:CLR          :rem 171
20 IFK<>79727THENPRINT"ERROR IN DATA":STO
   P                              :rem 129
55 POKE6656,0:POKE44,26:NEW       :rem 85
2080 DATA11,173,20,145,205,127,63,144,18,
     141,127,63,140,128,63        :rem 19
```

If you are using tape instead of disk, in line 40 of Program 1 change the 8 to a 1. Make sure that the second part is saved immediately after the first part on the tape. To run either version, run the first part. The second part will load and run automatically.

The Atari version requires at least 32K RAM. Atari users should simply type in Program 4 and save it before running.

Apple users should consult the accompanying Notes for special instructions.

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PFS:FILE and PFS:REPORT are now available for your Commodore 64. With electronic filing software this powerful, you can organize your life in hundreds of ways. PFS: Software makes it easy.

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59. You can keep track of favorite restaurants.
60. And your children can manage their paper routes. 61. Catalogue their baseball cards. 62. Keep track of their butterfly collections.
63. And their stamp collections.
64. They can even list their chores!

PFS SOFTWARE
The Power of Simplicity

PFS:FILE and PFS:REPORT currently work on Commodore 64, Apple,® IBM,® Macintosh, Tandy, DEC, Compaq, Hewlett Packard, NEC, Panasonic, Polo, Texas Instruments, Columbia, Corona, Eagle and Hyperion personal computers.

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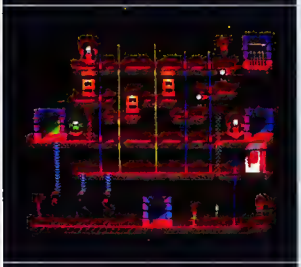
When you shopped for a computer, you wanted one with a lot of intelligence. This game may lead you to regret that choice, as your friendly little computer becomes the brains behind the most fantastic enemy you will ever face: The War Machine.

A monstrous artificial intelligence directs an endless army of self-replicating robot weapons and a complex of factories hidden on six heavily defended islands. Even as you strike at one island, robots beyond your field of vision continue to multiply...to repair the damage you've done...to attack and destroy.

Before all of Humankind is crushed beneath the Bungeling Empire's iron heel, one faint hope remains: you in your helicraft.



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Ever dream that you were locked in a haunted castle, wandering blindly through darkened corridors, never knowing what ghastly demons await you? Then you'll feel right at home in *The Castles of Doctor Creep*.

It's a maddening maze of 13 separate castles, more than 200 rooms in all. Sinister surprises await you behind every door: mummies and monsters, forcefields and death rays, trap doors and dead—*very* dead—ends. Remember where you've been and watch where you're going...there's got to be a way out *somewhere*!

Better hurry, or you'll wind up playing a rather unpleasant role in one of Doctor Creep's experiments.

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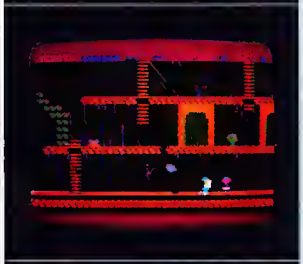
Who knows what fabulous treasures—and unspeakable dangers—await you in the world's deepest cave? This is one game you can really get into... and into...and into.

Wander through miles of uncharted passageways, swinging on ropes and ladders, tumbling over subterranean falls and plunging to the very depths of the earth on an abandoned mine railroad. Deadly steam vents and boiling lava pits threaten you at every turn. Chattering bats and the Spirits of dead Spelunkers beg you to join them, permanently.

Let's face it: you're in deep, deep trouble.



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You're the star of a full-fledged arcade adventure—and the big question is whether it'll turn out to be a comedy or a tragedy. That's because your co-star and beloved brother, Archaeologist Fenton Q. Fogbank, is rather absent-minded and extremely accident-prone.

As you search for priceless treasures in steaming tropical jungles, ancient cliff villages, musty old tombs and glittering crystal caverns, you control both your character and your brother. The only way to keep him on track and out of trouble is to whistle and pray that he follows you to safety.

Poison arrows, runaway boulders, fearsome frogs and mysterious mummies are only a few of the hazards that'll make you wish you weren't your brother's keeper.

STEALTH™

You're all alone on a strange and forbidding planet. On the distant horizon, looming thousands of meters above the blasted landscape, lies your destination: The Dark Tower, home of the mysterious Council of Nine, cruel overlords of a conquered world.

You must maneuver your Stealth Starfighter through an unending assault by the Council's automated arsenal—jets and heat-seeking missiles, photon tanks and anti-aircraft batteries, vaporizing volcanoes and deadly energy fields. Outgunned and outmanned, you must press ever onward, with only your stealth to rely on.

You must reach the Tower. You must destroy it. There's no turning back.

All titles available on Commodore 64. Championship Lode Runner *also available on Apple II+, IIe, IIc.* Whistler's Brother, Spelunker *and* Stealth *also available for Atari Home Computers. Commodore 64 is a trademark of Commodore Electronics, Ltd. Apple is a trademark of Apple Computer, Inc. Atari is a trademark of Atari Corporation.*

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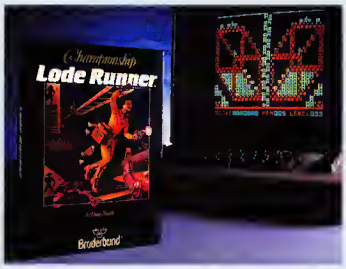

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Joystick Input

After running the program, you will be asked to specify several play options. You can choose among five skill levels; start a new game or set up any position; play against the computer or watch it play against itself; or play either the white or black pieces. All of these options will be discussed in greater detail later, but for now, type 1 at each prompt. This puts you in command of the white pieces versus the computer on level one, the easiest level.

The first time the program is run, you need to wait a few seconds while the computer gets its brain in order. Then the board will be displayed with your pieces on the bottom of the screen and the computer's pieces on the top. You should see a frame around the square in the lower-left corner of the board (the VIC version uses a blinking square). This is the cursor which takes the place of your hand to move pieces around the board.

Use the joystick (plugged into port 2 on the 64, port 1 on the Atari) to move the cursor atop the piece you wish to move. Press and release the joystick button. Now move the cursor to the square you want to move to and tap the button again. Your piece moves to the new square, and the computer responds almost instantly with its move.

A Spectacular Blunder

Did you make a foolish move? No problem. One of the most valuable features of Chess is the ability to change the position by adding or deleting pieces. This feature is especially useful for those of us who frequently manage to maneuver into a superior position, only to throw it all away in a single, spectacular blunder.

A piece can be deleted by positioning the cursor on the piece and pressing the space bar. To add a piece or change a piece to a different one, move the cursor to the appropriate square and press P, N, B, R, Q, or K for pawn, knight, bishop, rook, queen, or king, respectively. This will put one of *your* pieces on the square. To add one of the computer's pieces, hold down the SHIFT key (CONTROL key on the Atari) while pressing one of these editing keys.

To take back a move, use the editing keys to delete your piece and put it back on its original square. Don't forget to take back the computer's move, too.

The editing feature also enables you to make special moves which cannot be made with the joystick alone such as castling and *en passant* captures. For example, castling can be accomplished by deleting the king and putting it on its new square, and then moving the rook as you normally would with the joystick. Although *you* can make these special moves, the computer will never castle or capture *en passant* because, due to their complexity, these moves were not included in its thinking routine.

"Chess" on the Commodore 64.

Strange Chess

Although the computer will always make a legal move, it doesn't check to see that you do the same. You are free to move any of your pieces to any square without so much as a contemptuous buzz from the computer. If you're an experienced player, this shouldn't be a problem. If you're a beginner, however, you may want to familiarize yourself with the basic rules of chess lest you end up playing strange chess, a personal version which bears little resemblance to the real game. On the other hand, if you like to fudge a bit, the computer will make it easy. It will politely acquiesce to your most surreal moves.

When a pawn reaches the other side of the board, it's automatically promoted to a queen. If you would rather have a knight, bishop, or rook, you can easily make the change using the editing keys.

VIC-20 "Chess."

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Checkmate

The computer thinks by analyzing thousands of possible moves and countermoves and choosing what it considers to be the best move based on the relative value of the pieces (see "How *Chess* Thinks"). Most positions don't have just one best move but several which are equally good, in which case the computer chooses among them at random. This random factor insures that every game will be different, and makes for varied and interesting play.

Play continues until one side is either checkmated or stalemated. The computer will then stop play and indicate which side has won.

There are a few quirks in the way the computer determines whether checkmate has occurred. On levels three through five, it announces checkmate prematurely. When this happens, the computer has determined that it's impossible to avoid checkmate on the *next* move or two, assuming both sides make the best moves.

Also, the computer doesn't know the subtle difference between checkmate and stalemate. Consequently, when stalemate occurs, it will announce checkmate although, in fact, the game is a draw. Since the computer tries as hard as it can to checkmate its opponent, it will also try to achieve stalemate, possibly forcing a draw when it could have won. Fortunately, this rarely happens because the conditions for stalemate exist only in unusual circumstances such as when one side has only the king remaining.

Also, the computer won't give you any hint when your king is in check (not checkmate). So be extra careful that you don't leave your king in check or move into check. Otherwise, your king would be in check during the computer's turn to move—a highly unorthodox if not illegal position. The computer's reply to such a position is unpredictable, but it usually announces checkmate, forcing you to restart the game.

In any case, when the computer announces checkmate, press the joystick button to start a new game. If you want to try out some of the other play options without waiting till checkmate, you can start a new game at any time by pressing RUN/STOP–RESTORE (RESET on the Atari) and running the program again.

Play Options

When you choose the black pieces, the board will revolve so that you still play from the bottom. Since the player with the white pieces always moves first, you must wait for the computer to move before you will be allowed to make your first move.

If you become mentally exhausted after several bouts against the computer, give your brain a rest and watch the computer play itself. When you select this option, just set the joystick aside and sit back and watch the action. Beginners will find this feature an excellent way to learn some good strategies to use against the computer.

"Chess," Atari version.

You don't have to begin a game from the starting position. If you choose the option to set up a position, an empty board will be displayed and you can use the editing keys to place pieces on the board in any position. When the position is set up, the computer will start thinking after you make your first move.

This feature is especially useful for continuing a previous game or creating a problem for the computer to solve. It also allows you to experiment with hypothetical or downright ridiculous positions. Live out your fantasy by giving yourself ten queens versus the computer's lone king. The position doesn't even have to be a legal one. You could invent your own type of chess by giving each side two kings, for example, although the computer may get confused trying to determine when checkmate has occurred.

"Chess," Apple version.

/OH NO, NOT AGAIN./

SON of ARCHON.

Jon Freeman, Paul Reiche III and Anne Westfall created Archon, the 1983 "Game of the Year" according to Softline and Creative Computing. Recent evidence, however, indicates they were not satisfied with this.

If you took all the hours spent by all the people who've played Archon and put them together, there's a good chance it'd amount to more human effort than it took to put a man on the moon.

The Archon Dragon.

What does this mean? Is it a good thing? And why, in light of this, did the people pictured here decide to issue a scorching sequel named *Archon II: ADEPT?*

For starters, we don't really know what it means. Except that a lot of people who had a pretty good time with *Archon* are about to get more of what they like. And people who've yet to experience the best-selling, award-winning, knuckle-whitening original have *two* good things coming their way.

The Archon Basilisk.

Point two: If there's a moral issue here, we see it this way: A wise man once said, "I ain't never had too much fun." We agree. And we think that once you get your hands on *Archon II: ADEPT*, you'll see his point.

Now for the third question. Why a sequel? Well, there are sequels and there are sequels. The good ones happen because people just haven't had enough of a good thing. Obviously we're here to tell you that *Archon II: ADEPT* falls into the right category.

The ADEPT Chimera.

Where Archon took inspiration from chess, fantasy role-playing characters and arcade combat, *ADEPT* comes more from a world of its own making. Like *Archon*, it pits the forces of good against those of evil. But in place of the chessboard motif there is a map of elements—Earth, Air, Fire and Water. The role of magic is greater. The strategies are deeper. Things move faster. And the hidden algorithms that control the computer's play are considerably smarter.

The ADEPT Thunderbird.

Having already spent the better part of a month playing *ADEPT* (in order to write this ad, of course), we're quite confident it will seduce you too.

And if, by some strange chance, there is a parallel universe in which computer simulations come to life, we are confident that a large part of its population has Jon Freeman, Paul Reiche III and Anne Westfall to thank for their brief and miserable existence.

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MACHINE REQUIREMENTS: *Archon* is available on the Apple II, II+, IIe & IIc, IBM-PC, PCXT & PCjr, Commodore 64 and Atari. *Archon II: ADEPT* is available on the Commodore 64 and Atari.

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How *Chess* Thinks

You've probably heard that if a monkey sat down at a typewriter and pecked randomly at the keys for a long enough period of time, it would eventually type the complete works of Shakespeare. Theoretically, this is indeed possible—given enough time. There's the rub. At a brisk typing speed of 50 words per minute, it would take that poor monkey billions of years just to type "To be, or not to be." Nevertheless, there is power in trial and error.

The Minimax Algorithm

Substitute the monkey for a high-speed computer, and this technique becomes a practical method of imitating intelligence. In fact, it has been used with great success in the field of artificial intelligence. This program uses a popular trial-and-error technique known as the *minimax* algorithm.

The computer looks at the present board position and mentally moves the pieces through all the possible combinations of future moves and countermoves up to a certain point, say three moves ahead. For each combination, it calculates a score based on which pieces were captured during the combination. Each piece is worth a certain number of points depending on its general importance: 1 point for a pawn, 3 for a knight or bishop, 5 for a rook, 9 for a queen, and 46 for a king. (Of course, since you lose the game if your king cannot escape capture, the value of a king is actually infinite, but 46 is high enough to convince the computer that it's a bad move.)

When, in a move being examined, the computer captures an opponent's piece, the value of that piece is added to the score. Conversely, when one of the computer's pieces is captured, its value is subtracted from the score. Thus, a high score is considered good for the computer, and a low score is good for its opponent.

The task is to find the combination that represents best play for *both* sides. This combination is not necessarily the one with the maximum score, because while the computer is trying to maximize the score, its opponent is trying just as hard to minimize it. The best combination gives maximum scores during the computer's moves, and minimum scores during the opponent's moves.

After the best combination has been found, the computer's best move in the present position is simply the first move in the combination. The problem has been reduced from analyzing a chess position to finding the maximum and minimum of a series of numbers, which is much better suited to a computer.

50 Million Combinations On Level 5

Like most algorithms based on trial and error, this one requires sifting through an enormous number of combinations to find the best one. Fortunately, a few tricks can be used to reduce the combinations to a manageable number. This algorithm uses a technique called *alpha-beta cutoff*. It makes the computer search more intelligently, giving it the seemingly paradoxical ability to find the best move without looking at all the possible combinations. On level 5, for example, instead of having to search through roughly 2 billion combinations, it looks at only 50 million.

Even so, it would take BASIC from now till 1986 to generate that many combinations. That's why the algorithm is programmed in machine language. An advanced programming technique known as *recursion* (making a subroutine call itself) is used to generate all the possible combinations of moves. Capable of analyzing about 5000 combinations per second, this routine provides a moderate challenge at a reasonable playing speed.

One of the advantages of a computer opponent over a human is that you can tell the computer exactly how hard you want it to try to beat you, and it will obediently play at that level of difficulty. This is important because it's no fun if you always lose or always win effortlessly.

You have five skill levels to choose from. The difference between one level and another is the number of moves ahead that the computer looks. On level 1, for example, it looks two moves ahead (its move and your reply). Each succeeding level looks ahead one more move than the previous level.

Alas, the smarter play on the higher levels doesn't come without a price. The further ahead the computer looks, the more moves it must examine and, hence, the longer it thinks. The thinking time varies greatly depending on the

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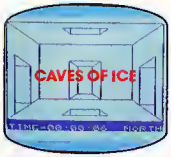

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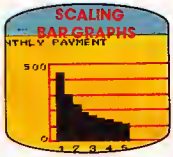

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level (about one second per move on level 1; about two *hours* on level 5).

Here's a rundown of the five levels:

Level 1: Beginner. Thinking time: one second. Look ahead: two moves. Fast but dumb.

Level 2: Intermediate. Thinking time: five seconds. Look ahead: three moves. Provides a reasonable challenge for impatient players.

Level 3: Tournament. Thinking time: two minutes. Look ahead: four moves. Since the usual time limit for tournament play is 40 moves in two hours, an average of three minutes per move, this level is best suited for serious players.

Level 4: Mate in two. Thinking time: 30 minutes. Look ahead: five moves. Capable of solving most mate-in-two problems.

Level 5: Postal chess. Thinking time: two hours. Look ahead: six moves. Simulates postal chess games where there is no time limit. Can avoid checkmate in two moves.

The thinking times given here are average times. The actual time ranges from half to twice the average time depending on the position.

Level 4 can be used to solve mate-in-two problems such as those published in many newspapers. Just select the following options: level 4, set up position, computer versus itself. Enter the position using the editing keys, and then make a do-nothing move by positioning thecursor over a white piece and pressing the joystick button twice. After several minutes of deep thought, the computer should respond by moving one of the white pieces (the solution) and announcing checkmate. The only mate-in-two problems that the computer cannot solve are those which involve castling, *en passant* captures, or pawn promotion.

If you have a Commodore 64 or VIC and don't want to type in this program, send a blank cassette or formatted disk, a self-addressed, stamped mailer, and $3 to the address below, and I'll make you a copy. Be sure to indicate which computer version you want.

John Krause
402 Monmouth Drive
Greensboro, NC 27410

Program 1: VIC And 64 Chess (Program Loader)

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 FORI=15449TO16200:READJ:POKEI,J:K=K+J:
   NEXT                                  :rem 52
20 IFK<>79786THENPRINT"ERROR IN DATA":STO
   P                                     :rem 134
30 POKE631,13:POKE632,13:POKE633,13:POKE1
   98,3                                  :rem 79
40 PRINT"{CLR}{3 DOWN}LOAD"CHR$(34)"CHESS
   2"CHR$(34)",8                         :rem 255
50 PRINT"{5 DOWN}RUN{HOME}               :rem 113
2000 DATA21,12,248,237,235,244,8,19,10,11
     ,1,247,246,245,255                  :rem 126
2010 DATA9,11,247,245,9,10,1,246,255,46,9
     ,5,3,3,1                            :rem 138
2020 DATA0,1,3,3,5,9,46,120,169,192,141,1
     28,63,162,0                         :rem 23
2030 DATA142,127,63,202,142,126,63,76,97,
     61,189,108,63,24,125                :rem 244
2040 DATA116,63,72,168,185,136,63,188,108
     ,63,153,136,63,104,168              :rem 101
2050 DATA189,76,63,153,136,63,24,105,6,16
     8,174,73,63,169,0                   :rem 109
2060 DATA157,129,63,174,126,63,185,113,60
     ,56,253,129,63,168,169              :rem 108
2070 DATA192,157,129,63,152,224,0,208,34,
     221,128,63,48,28,208                :rem 243
2080 DATA11,173,4,220,205,127,63,144,18,1
     41,127,63,140,128,63                :rem 223
2090 DATA173,108,63,141,124,63,173,116,63
     ,141,125,63,96,221,128              :rem 82
2100 DATA63,48,250,240,248,152,157,128,63
     ,189,75,63,24,105,6                 :rem 199
2110 DATA168,185,113,60,56,253,128,63,221
     ,127,63,48,59,224,1                 :rem 194
2120 DATA240,221,221,127,63,240,50,96,189
     ,108,63,24,125,116,63               :rem 23
2130 DATA141,75,63,168,185,136,63,172,74,
     63,208,6,201,1,16                   :rem 92
2140 DATA192,48,8,201,0,48,186,201,7,240,
     182,157,76,63,201                   :rem 88
2150 DATA6,240,4,201,250,208,12,169,46,15
     7,128,63,104,104,104                :rem 219
2160 DATA104,76,229,61,188,108,63,185,136
     ,63,172,75,63,153,136               :rem 55
2170 DATA63,188,108,63,169,0,153,136,63,2
     36,73,63,208,3,76                   :rem 108
2180 DATA144,60,232,142,126,63,169,20,157
     ,108,63,169,16,56,237               :rem 43
2190 DATA74,63,141,74,63,254,108,63,188,1
     08,63,185,136,63,201                :rem 0
2200 DATA7,240,86,172,74,63,240,4,201,0,1
     6,77,192,0,208                      :rem 183
2210 DATA4,201,1,48,69,201,0,16,9,188,108
     ,63,169,0,56                        :rem 91
2220 DATA249,136,63,201,1,208,6,32,5,62,7
     6,222,61,201,2                      :rem 175
2230 DATA208,6,32,192,62,76,222,61,201,3,
     208,6,32,218,62                     :rem 234
2240 DATA76,222,61,201,4,208,6,32,230,62,
     76,222,61,201,5                     :rem 223
2250 DATA208,6,32,242,62,76,222,61,32,47,
     63,76,222,61,189                    :rem 47
2260 DATA108,63,201,98,48,150,224,0,240,1
     6,169,16,56,237,74                  :rem 146
2270 DATA63,141,74,63,202,142,126,63,76,1
     44,60,173,124,63,24                 :rem 186
2280 DATA109,125,63,141,125,63,88,96,173,
     74,63,208,89,189,108                :rem 20
2290 DATA63,24,105,10,168,185,136,63,208,
     36,169,10,157,116,63                :rem 247
2300 DATA32,21,61,189,108,63,201,31,48,21
     ,201,39,16,17,24                    :rem 20
2310 DATA105,20,168,185,136,63,208,8,169,
     20,157,116,63,32,21                 :rem 186
2320 DATA61,189,108,63,24,105,9,168,185,1
     36,63,16,8,169,9                    :rem 65
2330 DATA157,116,63,32,21,61,189,108,63,2
     4,105,11,168,185,136                :rem 240
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```
2340 DATA63,16,8,169,11,157,116,63,32,21,
     61,96,189,108,63                  :rem 53
2350 DATA56,233,10,168,185,136,63,208,36,
     169,246,157,116,63,32             :rem 50
2360 DATA21,61,189,108,63,201,81,48,21,20
     1,89,16,17,56,233                 :rem 92
2370 DATA20,168,185,136,63,208,8,169,236,
     157,116,63,32,21,61               :rem 202
2380 DATA189,108,63,56,233,9,168,169,0,21
     7,136,63,16,8,169                 :rem 122
2390 DATA247,157,116,63,32,21,61,189,108,
     63,56,233,11,168,169              :rem 2
2400 DATA0,217,136,63,16,8,169,245,157,11
     6,63,32,21,61,96                  :rem 43
2410 DATA169,0,157,84,63,168,185,89,60,15
     7,116,63,32,21,61                 :rem 108
2420 DATA254,84,63,188,84,63,192,8,48,237
     ,96,169,4,157,100                 :rem 125
2430 DATA63,169,0,157,84,63,240,22,169,8,
     157,100,63,169,4                  :rem 51
2440 DATA157,84,63,208,10,169,8,157,100,6
     3,169,0,157,84,63                 :rem 106
2450 DATA168,185,105,60,157,116,63,157,92
     ,63,32,21,61,189,108              :rem 255
2460 DATA63,24,125,116,63,168,185,136,63,
     208,13,189,116,63,24              :rem 253
2470 DATA125,92,63,157,116,63,76,6,63,254
     ,84,63,189,84,63                  :rem 76
2480 DATA221,100,63,48,206,96,169,0,157,8
     4,63,168,185,97,60                :rem 167
2490 DATA157,116,63,32,21,61,254,84,63,18
     8,84,63,192,8,48                  :rem 68
2500 DATA237,96                        :rem 24
```

Program 2: 64 Chess (Main Program)

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10 POKE53280,9:POKE53281,9:POKE53272,21:P
   OKE53249,0                          :rem 143
20 PRINTCHR$(14)"{CLR}{DOWN}{WHT}"TAB(18)
   "CHESS"                             :rem 94
30 PRINTTAB(15)"{DOWN}{CYN}JOHN KRAUSE"
                                       :rem 108
40 FORI=16256TO16263:POKEI,192:NEXT
                                       :rem 109
50 FORI=16264TO16383:POKEI,7:NEXT :rem 11
60 FORI=16285TO16362:READJ:POKEI,J:NEXT
                                       :rem 191
70 FORI=54272TO54296:POKEI,0:NEXT :rem 12
80 POKE54296,15:POKE54273,34:POKE54277,10
                                       :rem 51
90 POKE53282,8:POKE53283,1            :rem 203
100 POKE2040,14:POKE53287,7:POKE53277,1:P
   OKE53271,1                          :rem 130
110 D$=" PNBRQKPNBRQK"                 :rem 23
120 PRINT"{2 DOWN}{YEL}ENTER SKILL LEVEL
   {SPACE}(1-5)"                       :rem 253
130 GETA$:IFA$=""THEN130               :rem 75
140 IFVAL(A$)=0ORVAL(A$)>5THEN130:rem 154
150 POKE16201,VAL(A$)                 :rem 132
160 PRINT"{DOWN}{RVS}1{OFF} NEW GAME OR
   {RVS}2{OFF} SET UP POSITION?":rem 142
170 GETE$:IFE$=""THEN170               :rem 91
180 IFVAL(E$)=0ORVAL(E$)>2THEN170:rem 167
190 PRINT"{DOWN}COMPUTER VS. {RVS}1{OFF}
   {SPACE}YOU OR {RVS}2{OFF} ITSELF?"
                                       :rem 145
200 GETA$:IFA$=""THEN200               :rem 71
210 IFVAL(A$)=0ORVAL(A$)>2THEN200:rem 147
220 POKE16202,0:B$="2":IFA$="2"THENPOKE16
   202,16:B$="1":GOTO260               :rem 151
230 PRINT"{DOWN}YOU HAVE THE {RVS}1{OFF}
   {SPACE}WHITE OR {RVS}2{OFF} BLACK PIE
   CES?"                               :rem 27
240 GETB$:IFB$=""THEN240               :rem 81
250 IFVAL(B$)=0ORVAL(B$)>2THEN240:rem 157
260 IFPEEK(12288)<>60THENGOSUB380:rem 204
270 GOSUB490                           :rem 182
280 IFA$="1"ANDB$="1"THEN320           :rem 239
290 IFE$="2"THENGOSUB690:POKE53269,0
                                       :rem 98
300 GOTO330                            :rem 98
310 IFA$="2"THEN330                     :rem 0
320 GOSUB690:POKE53269,0:POKE16202,0
                                       :rem 66
330 SYS15486:IFPEEK(16256)<229ANDPEEK(162
   56)>150THENI=0:GOTO1070            :rem 250
340 J=PEEK(16252)+16264:R=INT(J/10-1628.5
   ):C=J-162B5-10*R:GOSUB930           :rem 153
350 J=PEEK(16253)+16264:R=INT(J/10-1628.5
   ):C=J-162B5-10*R:GOSUB9B0           :rem 160
360 IFPEEK(16256)<99ANDPEEK(16256)>27THEN
   I=1:GOTO1070                        :rem 101
370 GOTO310                            :rem 103
380 PRINT"{DOWN}{CYN}PLEASE WAIT..."
                                       :rem 21
390 POKE56334,0:POKE1,51               :rem 88
400 FORI=0TO431:POKEI+12288,PEEK(I+53248)
   :NEXT                               :rem 227
410 POKE1,55:POKE56334,1               :rem 86
420 FORI=12792TO12799:POKEI,85:NEXT
                                       :rem 123
430 FORI=0TO3B3:READJ:POKE12B00+I,J
                                       :rem 99
440 POKE13184+I,JOR85                 :rem 192
450 POKE13568+I,JAND170                :rem 36
460 POKE13952+I,(JAND170)OR(255-JAND85):N
   EXT                                 :rem 49
470 FORI=896TO922:READJ:POKEI,J:NEXT
                                       :rem 48
480 FORI=923TO958:POKEI,0:NEXT:RETURN
                                       :rem 145
490 POKE53272,29:POKE53270,216         :rem 149
500 PRINT"{CLR}{2 DOWN}"TAB(14)"{CYN}LEVE
   L"PEEK(16201)                       :rem 115
510 PRINT"{13}";:IFB$="1"THEN530       :rem 203
520 POKE53283,0:PRINT"{23}";:POKE16288,6:P
   OKE162B9,5:POKE16358,250:POKE16359,25
   1                                   :rem 18
530 IFE$="1"THEN560                    :rem 12
540 FORI=0TO7:FORJ=0TO7:POKE16285+10*I+J,
   0:NEXT:NEXT                         :rem 243
550 PRINT:GOSUB1170:GOSUB1170:GOTO680
                                       :rem 62
560 PRINT"{DOWN} {RVS}HIJK{OFF}HIJK{RVS}@
   ABC{OFF}{SHIFT-SPACE}{K}{I}{T}{RVS}XY
   Z[{OFF}PQRS{U}{O}@{F}XYZ+"          :rem 57
570 PRINT" {RVS}LMNO{OFF}LMNO{RVS}DEFG
   {OFF}{@}{G}{+}{M}{RVS}£]↑←{OFF}TUVW
   {C}{X}{V}{B}{-}-1{*}"               :rem 202
580 PRINT" *ABC{A}{E}{R}{W}*ABC{A}{E}{R}
   {W}*ABC{A}{E}{R}{W}*ABC{A}{E}{R}{W}"
                                       :rem 158
590 PRINT" DEFG{H}{J}{L}{Y}DEFG{H}{J}{L}
   {Y}DEFG{H}{J}{L}{Y}DEFG{H}{J}{L}{Y}"
                                       :rem 31
600 GOSUB1170                          :rem 223
610 C$=CHR$(34):PRINT" {RVS}PQRS ↓"C$"#PQ
   RS ↓"C$"#PQRS ↓"C$"#PQRS ↓"C$"#"
                                       :rem 229
```

```
620 PRINT" {RVS}TUVW$%&'TUVW$%&'TUVW$%&'T
    UVW$%&'"                          :rem 43
630 PRINT" {RVS}89:;XYZ+Ø123[A][B][R][W][H
    IJK{SHIFT-SPACE}[K][I][T]()*+[£][£
    [N][Q]"                           :rem 76
640 PRINT" {RVS}<=>?[-][-][*]4567[H][J][L]
    [Y][LMNO[@][G][+][M],-./[D][Z][S][P]"
                                      :rem 238
650 IFB$="1"THENRETURN                :rem 81
660 PRINT"{HOME}{4 DOWN}"SPC(13)"[£][£
    [N][Q]{RVS}PQRS"                  :rem 161
670 PRINTSPC(13)"{13 DOWN}{RVS}[U][O][@][F]
    *A8C{DOWN}"                       :rem 245
680 RETURN                            :rem 126
690 POKE53269,1                       :rem 52
700 GETC$:IFC$=""ORFTHEN780           :rem 68
710 N=Ø                               :rem 83
720 IFMID$(D$,N+1,1)=C$THEN750        :rem 129
730 N=N+1:IFN<13THEN720               :rem 78
740 GOTO780                           :rem 115
750 J=16285+C+10*R:IFN>6THENN=262-N
                                      :rem 249
760 IFNTHENGOSUB990:GOTO780           :rem 221
770 GOSUB940:FORI=ØTO1:FORP=ØTO3:POKEK+40
    *I+P,M:NEXT:NEXT                  :rem 182
780 I=NOTPEEK(56320)                  :rem 140
790 R=R-SGN((IAND2)-(IAND1))          :rem 81
800 C=C+SGN((IAND8)-(IAND4))          :rem 50
810 IFR<ØTHENR=Ø                      :rem 212
820 IFR>7THENR=7                      :rem 229
830 IFC<ØTHENC=Ø                      :rem 184
840 IFC>7THENC=7                      :rem 201
850 POKE53248,30+32*C:POKE53249,193-16*R
                                      :rem 167
860 IF(PEEK(56320)AND16)THEN700       :rem 244
870 J=16285+C+10*R                    :rem 162
880 IFFTHEN970                        :rem 68
890 IFPEEK(J)=ØORPEEK(J)>6THEN700:rem 248
900 F=1:GOSUB930                      :rem 163
910 IF(PEEK(56320)AND16)THEN700       :rem 240
920 GOTO910                           :rem 110
930 POKE54276,Ø:POKE54276,17          :rem 52
940 K=1745-80*R+4*C:N=PEEK(J):POKEJ,Ø
                                      :rem 103
950 M=32:IF(R+C)/2-INT((R+C)/2)THENM=63
                                      :rem 197
960 RETURN                            :rem 127
970 F=Ø                               :rem 83
980 FORI=ØTO1:FORP=ØTO3:POKEK+40*I+P,M:NE
    XT:NEXT                           :rem 98
990 K=1745-80*R+4*C                   :rem 216
1000 M=Ø:IF(R+C)/2-INT((R+C)/2)THENM=48
                                      :rem 182
1010 IFR=ØANDN=255THENN=251           :rem 92
1020 IFR=7ANDN=1THENN=5               :rem 150
1030 IFN<7THENM=M+96                  :rem 180
1040 POKEJ,N:IFN>6THENN=256-N         :rem 21
1050 FORI=ØTO1:FORJ=ØTO3:POKEK+40*I+J,56+
    M+8*N+4*I+J:NEXT:NEXT             :rem 51
1060 RETURN                           :rem 167
1070 IFPEEK(16202)THENI=I+1           :rem 34
1080 I=I+VAL(B$):PRINT"{DOWN}{CYN}CHECKMA
    TE!{2 SPACES}";                   :rem 249
1090 IFI/2-INT(I/2)THENPRINT"BLACK WINS."
    :GOTO1110                         :rem 24
1100 PRINT"WHITE WINS."               :rem 131
1110 POKE54273,40:POKE54276,Ø:POKE54276,1
    7                                 :rem 89
1120 FORI=ØTO999:NEXT                 :rem 40
1130 POKE54273,20:POKE54276,Ø:POKE54276,1
    7                                 :rem 89
1140 PRINT"PRESS JOYSTICK BUTTON."
                                      :rem 158
1150 IF(PEEK(56320)AND16)THEN1150 :rem 77
1160 RUN                              :rem 189
1170 FORI=1TO2:FORJ=1TO2              :rem 234
1180 PRINT" ????{4 SPACES}????{4 SPACES}?
    ???{4 SPACES}????{4 SPACES}":rem 139
1190 NEXT:FORJ=1TO2                   :rem 184
1200 PRINT"{5 SPACES}????{4 SPACES}????
    {4 SPACES}????{4 SPACES}????"
                                      :rem 132
1210 NEXT:NEXT:RETURN                 :rem 150
1220 DATA4,2,3,5,6,3,2,4,7,7,1,1,1,1,1,1,
    1,1,7                             :rem 193
1230 DATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7,7,Ø,Ø,Ø,Ø,Ø,
    Ø,Ø,Ø,7                           :rem Ø
1240 DATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7,7,Ø,Ø,Ø,Ø,Ø,
    Ø,Ø,Ø,7                           :rem 1
1250 DATA7,255,255,255,255,255,255,255,25
    5,7                               :rem 188
1260 DATA7,252,254,253,251,250,253,254,25
    2                                 :rem 69
1270 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 152
1280 DATAØ,Ø,Ø,3,15,15,3,15           :rem 65
1290 DATAØ,Ø,Ø,192,240,240,192,240
                                      :rem 164
1300 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 146
1310 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 147
1320 DATA3,3,15,63,63,Ø,Ø,Ø           :rem 66
1330 DATA192,192,240,252,252,Ø,Ø,Ø
                                      :rem 165
1340 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 150
1350 DATAØ,Ø,Ø,Ø,3,3,3,3              :rem 163
1360 DATAØ,192,240,255,255,63,255,255
                                      :rem 83
1370 DATAØ,Ø,Ø,Ø,240,252,252,255      :rem 61
1380 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 154
1390 DATA15,15,3,Ø,Ø,Ø,Ø,Ø            :rem 10
1400 DATA255,243,3,15,63,255,255,Ø
                                      :rem 178
1410 DATA255,255,255,255,255,255,255,Ø
                                      :rem 136
1420 DATAØ,192,192,192,192,192,192,Ø
                                      :rem 29
1430 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 150
1440 DATAØ,60,60,255,255,255,255,255
                                      :rem 31
1450 DATAØ,60,60,63,207,243,243,243
                                      :rem 225
1460 DATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø              :rem 153
1470 DATAØ,Ø,Ø,Ø,15,63,48,Ø           :rem 69
1480 DATA63,48,63,48,255,252,Ø,Ø      :rem 90
1490 DATA252,12,252,12,255,63,Ø,Ø:rem 121
1500 DATAØ,Ø,Ø,Ø,240,252,12,Ø        :rem 150
1510 DATAØ,3,3,3,Ø,Ø,Ø,Ø             :rem 158
1520 DATAØ,207,207,255,192,255,255,255
                                      :rem 132
1530 DATAØ,243,243,255,3,255,255,255
                                      :rem 28
1540 DATAØ,192,192,192,Ø,Ø,Ø,Ø       :rem 220
1550 DATAØ,Ø,Ø,Ø,3,15,15,Ø            :rem 8
1560 DATA255,255,255,192,255,255,255,Ø
                                      :rem 142
1570 DATA255,255,255,3,255,255,255,Ø
                                      :rem 38
1580 DATAØ,Ø,Ø,Ø,192,240,240,Ø       :rem 212
1590 DATAØ,Ø,Ø,Ø,48,48,12,12         :rem 123
1600 DATAØ,48,48,48,48,252,252,252
                                      :rem 192
1610 DATAØ,48,48,48,48,252,252,252
                                      :rem 193
```

```
1620 DATA0,0,0,0,48,48,192,192    :rem 231
1630 DATA15,3,3,3,3,3,3,0         :rem 224
1640 DATA255,0,255,252,255,0,255,0
                                  :rem 178
1650 DATA255,3,255,255,255,3,255,0
                                  :rem 188
1660 DATA192,0,0,0,0,0,0,0          :rem 7
1670 DATA0,0,0,15,63,63,63,15     :rem 179
1680 DATA0,63,51,60,243,255,240,252
                                  :rem 230
1690 DATA0,240,48,243,63,255,63,255
                                  :rem 243
1700 DATA0,0,0,192,240,240,240,192
                                  :rem 160
1710 DATA15,3,3,3,3,3,3,0         :rem 223
1720 DATA255,0,255,252,255,0,255,0
                                  :rem 177
1730 DATA255,3,255,255,255,3,255,0
                                  :rem 187
1740 DATA192,0,0,0,0,0,0,0          :rem 6
1750 DATA255,255,192,192,0,192,192,0,192
                                  :rem 235
1760 DATA192,0,192,192,0,192,192,0,192
                                  :rem 128
1770 DATA192,0,192,192,0,192,255,255,192
                                  :rem 237
```

Program 3: VIC Chess (Main Program)

Refer to "COMPUTE!'s Guide To Typing In Progroms" before entering this listing.

```
10 POKE36879,138:POKE36869,194    :rem 172
20 PRINT"{CLR}{WHT}"TAB(8)"{DOWN}CHESS
                                  :rem 84
30 PRINT"{DOWN}{CYN}{5 SPACES}JOHN KRAUSE
                                  :rem 188
40 FORI=16256TO16263:POKEI,192:NEXT
                                  :rem 109
50 FORI=16264TO16383:POKEI,7:NEXT :rem 11
60 FORI=16285TO16362:READJ:POKEI,J:NEXT
                                  :rem 191
70 D$=" PNBRQKPNBRQK"             :rem 236
80 PRINT"{2 DOWN}{YEL}SKILL LEVEL (1-5)?
                                  :rem 113
90 GETA$:IFA$=""THEN90            :rem 245
100 IFVAL(A$)=0ORVAL(A$)>5THEN90 :rem 107
110 POKE16201,VAL(A$)             :rem 128
120 PRINT"{DOWN}{RVS}1{OFF} NEW GAME
                                  :rem 172
130 PRINT"{RVS}2{OFF} SET UP POSITION
                                  :rem 159
140 GETE$:IFE$=""THEN140           :rem 85
150 IFVAL(E$)=0ORVAL(E$)>2THEN140:rem 161
160 PRINT"{DOWN}COMPUTER VS.       :rem 29
170 PRINT"{RVS}1{OFF} YOU          :rem 25
180 PRINT"{RVS}2{OFF} ITSELF      :rem 229
190 GETA$:IFA$=""THEN190           :rem 87
200 IFVAL(A$)=0ORVAL(A$)>2THEN190:rem 154
210 POKE16202,0:B$="2":IFA$="2"THENPOKE16
    202,16:B$="1":GOTO270         :rem 151
220 PRINT"{DOWN}YOU HAVE THE      :rem 214
230 PRINT"{RVS}1{OFF} WHITE PIECES:rem 83
240 PRINT"{RVS}2{OFF} BLACK PIECES:rem 49
250 GETB$:IFB$=""THEN250           :rem B3
260 IFVAL(B$)=0ORVAL(B$)>2THEN250:rem 159
270 IFPEEK(5120)<>28THENGOSUB390 :rem 149
280 GOSUB460                      :rem 1B0
290 IFA$="1"ANDB$="1"THEN330      :rem 241
300 IFE$="2"THENGOSUB660          :rem 137
310 GOTO340                       :rem 100
320 IFA$="2"THEN340                 :rem 2
330 GOSUB660:POKE16202,0          :rem 114
340 SYS15486:IFPEEK(16256)<229ANDPEEK(162
    56)>150THENI=0:GOTO1120       :rem 247
350 J=PEEK(16252)+16264:R=INT(J/10-1628.5
    ):C=J-16285-10*R:GOSUB980     :rem 159
360 J=PEEK(16253)+16264:R=INT(J/10-1628.5
    ):C=J-16285-10*R:GOSUB1030    :rem 196
370 IFPEEK(16256)<99ANDPEEK(16256)>27THEN
    I=1:GOTO1120                   :rem 98
380 GOTO320                       :rem 105
390 PRINT"{DOWN}{CYN}PLEASE WAIT...
                                  :rem 244
400 FORI=0TO431:POKE5120+I,PEEK(32768+I):
    NEXT                          :rem 170
410 FORI=0TO223:READJ:POKE6224+I,J:rem 45
420 POKE5776+I,JOR85              :rem 150
430 POKE6000+I,JAND170            :rem 225
440 POKE5552+I,(JAND170)OR(255-JAND85):NE
    XT                            :rem 252
450 RETURN                        :rem 121
460 POKE36869,205                 :rem 156
470 PRINT"{CLR}{DOWN}{CYN}{7 SPACES}LEVEL
    "PEEK(16201)"{DOWN}{WHT}      :rem 207
480 POKE36878,15:POKE646,9:IFB$="1"THEN50
    0                             :rem 128
490 POKE36878,31:POKE646,8:POKE16288,6:PO
    KE16289,5:POKE1635B,250:POKE16359,251
                                  :rem 233
500 IFE$="1"THEN530                 :rem 6

510 FORK=0TO70STEP10:FORJ=0TO7:POKE16285+
    K+J,0:NEXT:NEXT               :rem 54
520 GOSUB1210:GOSUB1210:RETURN    :rem 115
530 PRINT"{3 SPACES}{RVS}Z£{OFF}Z{-}
    {RVS}VX{OFF}{+}{£}{RVS} S{OFF}↑
    {SHIFT-SPACE}{RVS}RT{OFF}{I}{@}"
                                  :rem 16
540 PRINT"{3 SPACES}{RVS}[]{OFF}+-{RVS}WY
    {OFF}{M}{£}{RVS}#%{OFF}{*}{K}{RVS}SU
    {OFF}{T}{G}"                  :rem 34
550 PRINT"{3 SPACES}VX{RVS}NP{OFF}VX{RVS}
    NP{OFF}VX{RVS}NP{OFF}VX{RVS}NP"
                                  :rem 153
560 PRINT"{3 SPACES}WY{RVS}OQ{OFF}WY{RVS}
    OQ{OFF}WY{RVS}OQ{OFF}WY{RVS}OQ"
                                  :rem 170
570 GOSUB1210                     :rem 224
5B0 PRINT"{3 SPACES}{R}{H}:<{R}{H}:<{R}
    {H}:<{R}{H}:<"                :rem 222
590 PRINT"{3 SPACES}{W}{J};={W}{J};={W}
    {J};={W}{J};="                :rem 239
600 PRINT"{3 SPACES}FH{L}{U}BD{RVS}BD
    {OFF}NP@{C}>*{V}{RVS}@"       :rem 53
610 PRINT"{3 SPACES}GI{Y}{O}CE{RVS}CE
    {OFF}OQ{P}{X}?A{B}{RVS}A"     :rem 70
620 POKE4173,162                  :rem 91
630 IFB$="1"THENRETURN            :rem 79
640 PRINT"{HOME}{3 DOWN}"SPC(9)"{N}{D}
    {RVS}↑ "                      :rem 43
650 PRINT"{13 DOWN}"SPC(9)"{RVS}FH{OFF}JL
    {DOWN}":RETURN                :rem 240
660 GETC$:IFC$=""ORFTHEN740       :rem 69
670 N=0                           :rem 88
680 IFMID$(D$,N+1,1)=C$THEN710    :rem 130
690 N=N+1:IFN<13THEN680           :rem 88
700 GOTO740                       :rem 107
710 J=16285+C+10*R:IFN>6THENN=262-N
                                  :rem 245
720 IFNTHENGOSUB1040:GOTO740      :rem 248
730 GOSUB990:FORI=0TO1:FORP=0TO1:POKEK+22
    *P+I,M:NEXT:NEXT              :rem 181
```

```
740 POKE37154,127:I=PEEK(37152)ANO128:J=(
    I=Ø)                                :rem 2
750 POKE37154,255:I=PEEK(37151)  :rem 206
760 R=R+((IAND8)=Ø)-((IANO4)=Ø)  :rem 152
770 C=C+((IANO16)=Ø)-J           :rem 149
780 IFR<ØTHENR=Ø                 :rem 218
790 IFR>7THENR=7                 :rem 235
800 IFC<ØTHENC=Ø                 :rem 181
810 IFC>7THENC=7                 :rem 198
820 I=4473-44*R+C+C              :rem 223
830 J=PEEK(I)                    :rem 225
840 P=56:IFJ>106THENP=-P         :rem 181
850 POKEI,J+P:POKEI+22,J+P+1     :rem 148
860 POKEI+1,J+P+2:POKEI+23,J+P+3  :rem 81
870 FORP=ØTO70:NEXT              :rem 198
880 POKEI,J:POKEI+22,J+1         :rem 161
890 POKEI+1,J+2:POKEI+23,J+3      :rem 94
900 FORP=ØTO30:NEXT              :rem 188
910 IF(PEEK(37151)ANO32)THEN660  :rem 244
920 J=16285+C+10*R               :rem 158
930 IFFTHEN1020                   :rem 99
940 IFPEEK(J)=ØORPEEK(J)>6THEN660:rem 249
950 F=1:GOSUB980                 :rem 173
960 IF(PEEK(37151)AND32)THEN660  :rem 249
970 GOTO960                      :rem 120
980 POKE36876,225                :rem 163
990 K=4473-44*R+C+C:N=PEEK(J):POKEJ,Ø
                                 :rem 125
1000 M=54:IF(R+C)/2-INT((R+C)/2)THENM=110
                                 :rem 21
1010 POKE36876,Ø:RETURN          :rem 117
1020 F=Ø                         :rem 118
1030 FORI=ØTO1:FORP=ØTO1:POKEK+22*P+I,M:N
     EXT:NEXT                    :rem 131
1040 K=4473-44*R+C+C              :rem 12
1050 M=54:IF(R+C)/2-INT((R+C)/2)THENM=110
                                 :rem 26
1060 IFR=ØANDN=255THENN=251       :rem 97
1070 IFR=7ANON=1THENN=5          :rem 155
1080 IFN>7THENM=M+28             :rem 182
1090 POKEJ,N:IFN>6THENN=256-N     :rem 26
1100 FORI=ØTO1:FORJ=ØTO1:POKEK+22*J+I,M+4
     *N+I+J:NEXT:NEXT            :rem 169
1110 RETURN                      :rem 163
1120 IFPEEK(16202)THENI=I+1       :rem 30
1130 I=I+VAL(B$):PRINT"{OOWN}{CYN}CHECKMA
     TE! ";                      :rem 245
1140 IFI/2-INT(I/2)THENPRINT"BLACK WINS."
     :GOTO1160                   :rem 25
1150 PRINT"WHITE WINS."          :rem 136
1160 POKE36876,240:FORI=ØTO500:NEXT
                                 :rem 79
1170 POKE36876,195:FORI=ØTO500:NEXT:POKE3
     6876,Ø                      :rem 44
1180 PRINT"{UP}PRESS JOYSTICK BUTTON.";
                                 :rem 110
1190 IF(PEEK(37151)ANO32)THEN1190 :rem 84
1200 RUN                         :rem 184
1210 FORK=1TO2:FORJ=1TO2         :rem 231
1220 PRINT"{3 SPACES}R£2 S}RR£2 S}RR£2 S}R
     R£2 S}RR"                   :rem 150
1230 NEXT:FORJ=1TO2              :rem 179
1240 PRINT"{3 SPACES}RR£2 S}RR£2 S}RR
     £2 S}RR£2 S}"               :rem 152
1250 NEXT:NEXT:RETURN            :rem 154
1260 DATA4,2,3,5,6,3,2,4,7        :rem 23
1270 DATA7,1,1,1,1,1,1,1,1,7     :rem 102
1280 OATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7      :rem 95
1290 DATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7      :rem 96
1300 OATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7      :rem 88
1310 DATA7,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,7      :rem 89
1320 OATA7,255,255,255,255,255,255,255,25
     5,7                         :rem 186
1330 DATA7,252,254,253,251,250,253,254,25
     2                           :rem 67
1340 OATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
                                 :rem 118
1350 OATAØ,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
                                 :rem 119
1360 OATAØ,Ø,Ø,Ø,Ø,Ø,3,3,Ø,3,Ø,Ø,3,3,Ø,Ø,Ø
                                 :rem 135
1370 OATAØ,Ø,Ø,Ø,192,240,240,240,192,
     192,240,240,Ø,Ø,Ø           :rem 39
1380 DATAØ,48,63,63,63,15,63,63,60,60,60,
     Ø,3,15,15,Ø                 :rem 26
1390 DATAØ,Ø,Ø,192,240,240,252,252,252,25
     2,252,252,252,252,252,Ø     :rem 100
1400 OATAØ,3,15,15,15,15,15,15,15,Ø,3,Ø,3
     ,63,48,Ø                    :rem 107
1410 OATAØ,48,204,204,204,204,252,252,252
     ,Ø,240,Ø,240,63,3,Ø         :rem 139
1420 OATAØ,51,51,63,63,12,15,15,15,15,15,
     12,63,63,63,Ø               :rem 114
1430 OATAØ,204,204,252,252,48,240,240,240
     ,240,240,48,252,252,252,Ø   :rem 197
1440 OATAØ,3,3,3,51,51,51,63,15,Ø,15,15,1
     5,Ø,15,Ø                    :rem 105
1450 OATAØ,48,48,48,51,51,243,255,252,Ø,2
     52,60,252,Ø,252,Ø           :rem 71
1460 OATAØ,Ø,3,Ø,12,63,63,63,Ø,15,15,1
     5,Ø,15,Ø                    :rem 107
1470 OATAØ,192,240,192,204,63,255,255,255
     ,Ø,252,60,252,Ø,252,Ø       :rem 12
```

Program 4: Atari Chess

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
EC 10 POKE 106,87:GRAPHICS 0:POKE 53
      251,Ø
LL 20 POKE 712,148:OIM D$(13),Z$(272
      )
GI 30 D$=" PNBRQK{P}{N}{B}{R}{Q}{K}"
MF 40 OPEN #1,4,Ø,"K":POKE 752,1
AB 50 POKE 82,Ø:POSITION 17,1:? "CHE
      SS"
FG 60 POSITION 14,3:? "John Krause"
OP 70 FOR I=1 TO 269 STEP 4:READ K:F
      OR J=Ø TO 3:Z$((I+J),(I+J))=CH
      R$(K+J):NEXT J:NEXT I:Z$(60,60
      )=CHR$(Ø)
GD 80 Z$(17,20)="{Y}{Z}  ":Z$(232,23
      2)=CHR$(128):Z$(267,268)="  "
FM 90 FOR I=1591 TO 1598:POKE I,192:
      NEXT I
CB 100 FOR I=1599 TO 1718:POKE I,7:N
       EXT I
MM 110 FOR I=1620 TO 1697:REAO J:POK
       E I,J:NEXT I
GJ 120 ? "{2 DOWN}Enter skill level
       (1-5)"
DD 130 GET #1,A:IF A<49 OR A>53 THEN
        130
JJ 140 POKE 1536,A-48
AD 150 ? "{DOWN}■ New game or ■ Set
       up position?"
EC 160 GET #1,E:IF E<49 OR E>50 THEN
        160
AF 170 ? "{DOWN}Computer vs. ■ you o
       r ■ itself?"
DK 180 GET #1,A:IF A<49 OR A>50 THEN
        180
```

```
KN 190 POKE 1537,0:B=50:IF A=50 THEN
       POKE 1537,16:B=49:GOTO 220
GO 200 ? "{DOWN}You have the ■ white
       or ▨ black pieces?"
DB 210 GET #1,B:IF B<49 OR B>50 THEN
       210
MF 220 IF PEEK(24304)<>96 THEN GOSUB
       340
DB 230 I=USR(24333):GOSUB 420:GOSUB
       1100
JI 240 IF A=49 AND B=49 THEN 280
FI 250 IF E=50 THEN GOSUB 660
GM 260 GOTO 290
NF 270 IF A=50 THEN 290
MF 280 POKE 53251,16*C+64:GOSUB 1100
       :GOSUB 660:POKE 1537,0
HL 290 POKE 77,0:I=USR(24333):I=USR(
       23590):IF PEEK(1591)<229 AND
       PEEK(1591)>150 THEN I=0:GOTO
       990
GJ 300 J=PEEK(1587)+1599:R=INT(J/10-
       162):C=J-1620-10*R:GOSUB 860
GH 310 J=PEEK(1588)+1599:R=INT(J/10-
       162):C=J-1620-10*R:GOSUB 910
ND 320 IF PEEK(1591)<99 AND PEEK(159
       1)>27 THEN I=1:GOTO 990
GI 330 GOTO 270
NA 340 ? "{DOWN}Please wait ..."
NC 350 FOR I=1538 TO 1545:READ J:POK
       E I,J:NEXT I
CO 360 FOR I=24320 TO 24352:READ J:P
       OKE I,J:NEXT I
GN 370 FOR I=0 TO 391:READ J:POKE 22
       528+I,J
IL 380 POKE 203,J:M=USR(1538):POKE 2
       2920+I,PEEK(204):NEXT I
CP 390 FOR I=0 TO 207:POKE 23312+I,P
       EEK(57608+I):NEXT I
PK 400 FOR I=0 TO 39:POKE 23512+I,PE
       EK(57480+I):NEXT I
EH 410 FOR I=23552 TO 24304:READ J:P
       OKE I,J:NEXT I:RETURN
GK 420 GRAPHICS 0:POKE 756,88:POKE 8
       2,4:?
MP 430 POKE 559,46:POKE 53277,3
CJ 440 POKE 53251,64:POKE 707,216
DI 450 POKE 53259,1:POKE 54279,92
MB 460 POKE 623,1
HN 470 DL=PEEK(560)+256*PEEK(561)
FD 480 POKE DL+3,68
JH 490 FOR I=DL+6 TO DL+28:POKE I,4:
       NEXT I
BD 500 POKE DL+6,2
KG 510 POKE I,65:POKE I+1,0:POKE I+2
       ,DL/256
IH 520 POKE 708,39:POKE 710,0:POKE 7
       11,15:POKE 712,37
BP 530 IF B=50 THEN POKE 710,15:POKE
        711,0:POKE 1623,6:POKE 1624,
       5:POKE 1693,250:POKE 1694,251
EH 540 POSITION 16,1:? "mfwfm":POKE
       21374,PEEK(1536)+122
OE 550 IF E=49 THEN 580
IN 560 FOR I=0 TO 70 STEP 10:FOR J=0
        TO 7:POKE 1620+I+J,0:NEXT J:
       NEXT I
OP 570 ? :GOSUB 1110:GOSUB 1110:RETU
       RN
PH 580 ? :? Z$(1,32):? Z$(33,64):? Z
       $(65,96):? Z$(97,128)
GE 590 POKE 21454,91:POKE 21455,92
NJ 600 GOSUB 1110
PP 610 ? Z$(129,160):? Z$(161,192):?
        Z$(193,224):? Z$(225,256)
CC 620 IF B=49 THEN RETURN
IC 630 POSITION 16,3:? Z$(257,264)
KD 640 POSITION 16,17:? Z$(265,272):
       CHR$(29)
MA 650 POKE 22010,219:POKE 22011,220
       :RETURN
HM 660 IF PEEK(764)=255 OR F THEN 74
       0
DG 670 N=0:GET #1,D
AA 680 IF D$(N+1,N+1)=CHR$(D) THEN 7
       10
FI 690 N=N+1:IF N<13 THEN 680
GL 700 GOTO 740
LI 710 J=1620+C+10*R:IF N>6 THEN N=2
       62-N
MD 720 IF N THEN GOSUB 920:GOTO 740
EN 730 GOSUB 870:FOR I=0 TO 1:FOR P=
       0 TO 3:POKE K+40*I+P,M:NEXT P
       :NEXT I
CB 740 J=STICK(0)
MK 750 IF (J=7 OR J=5 OR J=6) AND C<
       7 THEN C=C+1:POKE 53251,16*C+
       64
CC 760 IF (J=11 OR J=9 OR J=10) AND
       C>0 THEN C=C-1:POKE 53251,16*
       C+64
NL 770 IF (J=14 OR J=10 OR J=6) AND
       R<7 THEN I=USR(24333):R=R+1:G
       OSUB 1100
MP 780 IF (J=13 OR J=5 OR J=9) AND R
       >0 THEN I=USR(24333):R=R-1:GO
       SUB 1100
HC 790 IF STRIG(0)=1 THEN 660
FO 800 J=1620+C+10*R
DG 810 IF F THEN 900
PG 820 IF PEEK(J)=0 OR PEEK(J)>6 THE
       N 660
KH 830 F=1:GOSUB 860
GO 840 IF STRIG(0)=1 THEN 660
HC 850 GOTO 840
OG 860 SOUND 0,99,10,8
KD 870 K=21996-80*R+4*C:N=PEEK(J):PO
       KE J,0
NF 880 M=48:IF (R+C)/2-INT((R+C)/2)
       THEN M=97
II 890 SOUND 0,0,0,0:RETURN
EM 900 F=0
PE 910 FOR I=0 TO 1:FOR P=0 TO 3:POK
       E K+40*I+P,M:NEXT P:NEXT I
AL 920 K=21996-80*R+4*C
CI 930 M=120:IF (R+C)/2-INT((R+C)/2)
        THEN M=169
DH 940 IF R=0 AND N=255 THEN N=251
HB 950 IF R=7 AND N=1 THEN N=5
MJ 960 POKE J,N:IF N>6 THEN N=256-N:
       M=M-128
AK 970 FOR I=0 TO 1:FOR J=0 TO 3:POK
       E K+40*I+J,M+8*N+4*I+J:NEXT J
       :NEXT I
IB 980 RETURN
NB 990 IF PEEK(1537) THEN I=I+1
EF 1000 POKE DL+25,2:POKE DL+26,2:PO
       KE DL+27,2
HP 1010 I=I+B:POSITION 4,20:? "difdl
       nbuf":POSITION 26,20
BA 1020 IF I/2-INT(I/2) THEN ? "cmbd
       lPxjot":GOTO 1040
IC 1030 ? "xijufPxjot"
```

```
MM 1040 SOUND 0,50,10,12:FOR I=0 TO
        50:NEXT I
PJ 1050 SOUND 0,100,10,12:FOR I=0 TO
         50:NEXT I
JE 1060 SOUND 0,0,0,0
YP 1070 POSITION 9,22:? "qsfttPkpztu
        jd1Pcvuupo"
FK 1080 IF STRIG(0) THEN 1080
LP 1090 RUN
LE 1100 POKE 24326,212-8*R:I=USR(243
        20):RETURN
DE 1110 FOR I=1 TO 2:FOR J=1 TO 2
FH 1120 ? "aaaaPPPPaaaaPPPPaaaaPPPPa
        aaaPPPP"
PM 1130 NEXT J:FOR J=1 TO 2
FJ 1140 ? "PPPPaaaaPPPPaaaaPPPPaaaaP
        PPPaaaa"
CM 1150 NEXT J:NEXT I:RETURN
GL 1160 DATA 9,40,1,64,64,48,89,56,1
        3,44,5,68,21,52,93,60
AH 1170 DATA 32,81,32,81,32,81,32,81
        ,36,85,36,85,36,85,36,85
AE 1180 DATA 209,160,209,160,209,160,
        209,160,213,164,213,164,213
        ,164,213,164
BK 1190 DATA 184,217,176,145,200,129
        ,168,137,188,221,180,149,204
        ,133,172,141
GH 1200 DATA 72,17,153,192
MA 1210 DATA 4,2,3,5,6,3,2,4,7,7,1,1
        ,1,1,1,1,1,7
PP 1220 DATA 7,0,0,0,0,0,0,0,0,7,7,0
        ,0,0,0,0,0,0,0,7
AA 1230 DATA 7,0,0,0,0,0,0,0,0,7,7,0
        ,0,0,0,0,0,0,0,7
LL 1240 DATA 7,255,255,255,255,255,2
        55,255,255,7
EE 1250 DATA 7,252,254,253,251,250,2
        53,254,252
BP 1260 DATA 165,203,9,85,133,204,10
        4,96
AP 1270 DATA 160,8,185,25,95,153,0,9
        5,136,16,247,104,96
AJ 1280 DATA 160,128,169,0,153,128,9
        5,136,16,250,104,96
PK 1290 DATA 255,129,129,129,129,129
        ,129,255
JC 1300 DATA 0,0,0,0,0,0,0,0
DL 1310 DATA 0,0,0,3,15,15,3,15
JD 1320 DATA 0,0,0,192,240,240,192,2
        40
JF 1330 DATA 0,0,0,0,0,0,0,0
JG 1340 DATA 0,0,0,0,0,0,0,0
EF 1350 DATA 3,3,15,63,63,0,0,0
KI 1360 DATA 192,192,240,252,252,0,0
        ,0
JJ 1370 DATA 0,0,0,0,0,0,0,0
KG 1380 DATA 0,0,0,0,3,3,3,3
FG 1390 DATA 0,192,240,255,255,63,25
        5,255
DH 1400 DATA 0,0,0,0,240,252,252,255
JE 1410 DATA 0,0,0,0,0,0,0,0
AE 1420 DATA 15,15,3,0,0,0,0,0
LF 1430 DATA 255,243,3,15,63,255,255
        ,0
IL 1440 DATA 255,255,255,255,255,255
        ,255,0
CA 1450 DATA 0,192,192,192,192,192,1
        92,0
JJ 1460 DATA 0,0,0,0,0,0,0,0
CC 1470 DATA 0,60,60,255,255,255,255
        ,255
DE 1480 DATA 0,60,60,63,207,243,243,
        243
JM 1490 DATA 0,0,0,0,0,0,0,0
DP 1500 DATA 0,0,0,0,0,15,63,48,0
FE 1510 DATA 63,48,63,48,255,252,0,0
HD 1520 DATA 252,12,252,12,255,63,0,
        0
JJ 1530 DATA 0,0,0,0,240,252,12,0
KB 1540 DATA 0,3,3,3,0,0,0,0
IH 1550 DATA 0,207,207,255,192,255,2
        55,255
BP 1560 DATA 0,243,243,255,3,255,255
        ,255
NP 1570 DATA 0,192,192,192,0,0,0,0
AL 1580 DATA 0,0,0,0,3,15,15,0
JB 1590 DATA 255,255,255,192,255,255
        ,255,0
CA 1600 DATA 255,255,255,3,255,255,2
        55,0
MB 1610 DATA 0,0,0,0,192,240,240,0
HF 1620 DATA 0,0,0,0,48,48,12,12
MD 1630 DATA 0,48,48,48,48,252,252,2
        52
ME 1640 DATA 0,48,48,48,48,252,252,2
        52
OK 1650 DATA 0,0,0,0,48,48,192,192
QD 1660 DATA 15,3,3,3,3,3,3,0
LF 1670 DATA 255,0,255,252,255,0,255
        ,0
LP 1680 DATA 255,3,255,255,255,3,255
        ,0
AK 1690 DATA 192,0,0,0,0,0,0,0
KN 1700 DATA 0,0,0,15,63,63,63,15
QA 1710 DATA 0,63,51,60,243,255,240,
        252
ON 1720 DATA 0,240,48,243,63,255,63,
        255
KD 1730 DATA 0,0,0,192,240,240,240,1
        92
DC 1740 DATA 15,3,3,3,3,3,3,0
LE 1750 DATA 255,0,255,252,255,0,255
        ,0
LO 1760 DATA 255,3,255,255,255,3,255
        ,0
AJ 1770 DATA 192,0,0,0,0,0,0,0
JQ 1780 DATA 0,0,0,0,0,0,0,0
MF 1790 DATA 21,12,248,237,235,244,8
        ,19,10,11,1,247,246,245
BB 1800 DATA 255,9,11,247,245,9,10,1
        ,246,255,46,9,5,3,3,1,0,1
LK 1810 DATA 3,3,5,9,46,120,169,192,
        141,55,6,162,0,142,54,6
DB 1820 DATA 202,142,53,6,76,8,93,18
        9,35,6,24,125,43,6,72,168
GP 1830 DATA 185,63,6,188,35,6,153,6
        3,6,104,168,189,3,6,153,63
MM 1840 DATA 6,24,105,6,168,174,0,6,
        169,0,157,56,6,174,53,6
OK 1850 DATA 185,24,92,56,253,56,6,1
        68,169,192,157,56,6,152
EH 1860 DATA 224,0,208,34,221,55,6,4
        8,28,208,11,173,10,210,205
LL 1870 DATA 54,6,144,18,141,54,6,14
        0,55,6,173,35,6,141,51,6,173
DD 1880 DATA 43,6,141,52,6,96,221,55
        ,6,48,250,240,248,152,157
AP 1890 DATA 55,6,189,2,6,24,105,6,1
        68,185,24,92,56,253,55,6
OM 1900 DATA 221,54,6,48,59,224,1,24
        0,221,221,54,6,240,50,96
```

```
FL 1910 DATA 189,35,6,24,125,43,6,14
        1,2,6,168,185,63,6,172,1,6
LH 1920 DATA 208,6,201,1,16,192,48,8
        ,201,0,48,186,201,7,240
FB 1930 DATA 182,157,3,6,201,6,240,4
        ,201,250,208,12,169,46,157
CD 1940 DATA 55,6,104,104,104,104,76
        ,140,93,188,35,6,185,63,6
CL 1950 DATA 172,2,6,153,63,6,188,35
        ,6,169,0,153,63,6,236,0,6
JN 1960 DATA 208,3,76,55,92,232,142,
        53,6,169,20,157,35,6,169,16
MB 1970 DATA 56,237,1,6,141,1,6,254,
        35,6,188,35,6,185,63,6,201,7
HB 1980 DATA 240,86,172,1,6,240,4,20
        1,0,16,77,192,0,208,4,201,1
GH 1990 DATA 48,69,201,0,16,9,188,35
        ,6,169,0,56,249,63,6,201,1
OM 2000 DATA 208,6,32,173,93,76,133,
        93,201,2,208,6,32,104,94
OI 2010 DATA 76,133,93,201,3,208,6,3
        2,130,94,76,133,93,201,4
PD 2020 DATA 208,6,32,142,94,76,133,
        93,201,5,208,6,32,154,94
EB 2030 DATA 76,133,93,32,215,94,76,
        133,93,189,35,6,201,98,48
GM 2040 DATA 150,224,0,240,16,169,16
        ,56,237,1,6,141,1,6,202,142
IN 2050 DATA 53,6,76,55,92,173,51,6,
        24,109,52,6,141,52,6,88,104
GL 2060 DATA 96,173,1,6,208,89,189,3
        5,6,24,105,10,168,185,63,6
DB 2070 DATA 208,36,169,10,157,43,6,
        32,188,92,189,35,6,201,31
MB 2080 DATA 48,21,201,39,16,17,24,1
        05,20,168,185,63,6,208,8,169
KB 2090 DATA 20,157,43,6,32,188,92,1
        89,35,6,24,105,9,168,185,63
JE 2100 DATA 6,16,8,169,9,157,43,6,3
        2,188,92,189,35,6,24,105,11
KL 2110 DATA 168,185,63,6,16,8,169,1
        1,157,43,6,32,188,92,96,189
MK 2120 DATA 35,6,56,233,10,168,185,
        63,6,208,36,169,246,157,43,6
AC 2130 DATA 32,188,92,189,35,6,201,
        81,48,21,201,89,16,17,56
GM 2140 DATA 233,20,168,185,63,6,208
        ,8,169,236,157,43,6,32,188
EE 2150 DATA 92,189,35,6,56,233,9,16
        8,169,0,217,63,6,16,8,169
HH 2160 DATA 247,157,43,6,32,188,92,
        189,35,6,56,233,11,168,169
HF 2170 DATA 0,217,63,6,16,8,169,245
        ,157,43,6,32,188,92,96,169
FO 2180 DATA 0,157,11,6,168,185,0,92
        ,157,43,6,32,188,92,254,11
NN 2190 DATA 6,188,11,6,192,8,48,237
        ,96,169,4,157,27,6,169,0,157
BM 2200 DATA 11,6,240,22,169,8,157,2
        7,6,169,4,157,11,6,208,10
JP 2210 DATA 169,8,157,27,6,169,0,15
        7,11,6,168,185,16,92,157,43
HA 2220 DATA 6,157,19,6,32,188,92,18
        9,35,6,24,125,43,6,168,185
DC 2230 DATA 63,6,208,13,189,43,6,24
        ,125,19,6,157,43,6,76,174
GE 2240 DATA 94,254,11,6,189,11,6,22
        1,27,6,48,206,96,169,0,157
GO 2250 DATA 11,6,168,185,8,92,157,4
        3,6,32,188,92,254,11,6,188
MP 2260 DATA 11,6,192,8,48,237,96
```

Apple Notes

The Apple version of "Chess" uses the DATA statements from Program 1. Type in Program 5 and add lines 2000 to 2500 from Program 1 (ignoring the *:rem* numbers, which are for Commodore owners using the "Automatic Proofreader"). Then substitute line 2080 with the following line and save the program before running it:

```
2080 DATA 11,173,35,192,205,127,
63,144,18,141,127,63,140,128,63
```

Use the A, S, D, and W keys to move the blinking cursor atop the piece you wish to move and press RETURN. Then move the cursor to the square on which you want to set the piece and hit RETURN again.

As in the other versions, the P, N, B, R, Q, and K keys let you add pieces to the board. To add one of the computer's pieces, hold down the CONTROL key while pressing one of these editing keys. Use the space bar to delete a piece.

When the computer announces checkmate, press any key to start a new game. You can start a new game at any time by pressing CONTROL–RESET and rerunning the program.

Program 5: Apple Chess (Main Program)

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
10  HIMEM: 15448
20  HOME : PRINT  TAB( 18)"CHESS"
30  PRINT : PRINT  TAB( 15)"JOHN KRAUSE
    "
40  DIM A(12),C(69)
50  FOR I = 16256 TO 16263: POKE I,192:
      NEXT I
60  FOR I = 16264 TO 16383: POKE I,7: NEXT
    I
70  FOR I = 16285 TO 16362: READ J: POKE
    I,J: NEXT I
80  FOR I = 0 TO 12: READ A(I): NEXT I
90 B(0) = 17118:B(1) = 18142:B(2) = 191
    66:B(3) = 20190:B(4) = 21214
100  FOR I = 0 TO 69: READ C(I): NEXT I
    : GOSUB 430
110  IF  PEEK (16200) <  > 96 THEN  GOSUB
    370
120  IF B$ = "2" THEN  POKE 16288,6: POKE
    16289,5: POKE 16358,250: POKE 1635
    9,251
130  IF E$ = "1" THEN 150
140  FOR R = 0 TO 7: FOR C = 0 TO 7: POKE
    16285 + 10 * R + C,0: NEXT C: NEXT
    R
150  HGR2 : FOR R = 0 TO 7: FOR C = 0 TO
    7
160 I =  PEEK (16285 + 10 * R + C)
```

```
170  GOSUB 820
180  NEXT C: NEXT R:R = 0:C = 0
190  IF A$ = "1" AND B$ = "1" THEN 230
200  IF E$ = "2" THEN  GOSUB 540
210  GOTO 240
220  IF A$ = "2" THEN 240
230  GOSUB 540: POKE 16202,0
240  CALL 15486: IF  PEEK (16256) < 229
      AND  PEEK (16256) > 150 THEN 310
250 J =  PEEK (16252) + 16264:R =  INT
     (J / 10 - 1628.5):C = J - 16285 -
     10 * R
260  CALL  - 198:K =  PEEK (J):I = 0:
     GOSUB 820:I = K
270 J =  PEEK (16253) + 16264:R =  INT
     (J / 10 - 1628.5):C = J - 16285 -
     10 * R
280  GOSUB 820
290  IF  PEEK (16256) > 99 OR  PEEK (16
     256) < 28 THEN 220
300 Z = 1
310  IF  PEEK (16202) THEN Z = Z + 1
320  FOR I = 1 TO 5: CALL  - 198: NEXT
     I
330 K = 2:Z = Z +  VAL (B$): IF Z / 2 -
     INT (Z / 2) THEN L = 15
340  GOSUB 910: GOSUB 900
350  IF  PEEK ( - 16368) < 128 THEN 350
360  TEXT : RUN
370  PRINT : PRINT : PRINT "PLEASE WAIT
     ..."
380  FOR I = 24576 TO 25275: READ J: POKE
     I,J:K = K + J: NEXT I
390  FOR I = 25276 TO 25339: POKE I,255
     : NEXT I
400  FOR I = 15449 TO 16200: READ J: POKE
     I,J:K = K + J: NEXT I
410  IF K = 134648 THEN  RETURN
420  POKE 16200,0: PRINT : PRINT "CHECK
      DATA STATEMENTS": STOP
430  PRINT : PRINT : PRINT "ENTER SKILL
      LEVEL (1-5)";
440  GET A$: IF  VAL (A$) = 0 OR  VAL (
     A$) > 5 THEN 440
450  POKE 16201, VAL (A$)
460  PRINT : PRINT : PRINT "(1) NEW GAM
     E OR (2) SET UP POSITION?";
470  GET E$: IF  VAL (E$) = 0 OR  VAL (
     E$) > 2 THEN 470
480  PRINT : PRINT : PRINT "COMPUTER VS
       (1) YOU OR (2) ITSELF?";
490  GET A$: IF  VAL (A$) = 0 OR  VAL (
     A$) > 2 THEN 490
500  POKE 16202,0:B$ = "2": IF A$ = "2"
      THEN  POKE 16202,16:B$ = "1": RETURN
510  PRINT : PRINT "YOU HAVE TH
     E (1) WHITE OR (2) BLACK      PIECE
     S?";
520  GET B$: IF  VAL (B$) = 0 OR  VAL (
     B$) > 2 THEN 520
530  RETURN
540 F = 0
550 I =  PEEK ( - 16388)
560  IF I = 215 AND R < 7 THEN R = R +
     1: GOTO 670
570  IF I = 193 AND C > 0 THEN C = C -
     1: GOTO 670
580  IF I = 211 AND R > 0 THEN R = R -
     1: GOTO 670
590  IF I = 196 AND C < 7 THEN C = C +
     1: GOTO 670
600  IF I < 128 OR I = 141 OR F THEN 67
     0
610 J = 0
620  IF A(J) = I THEN 650
630 J = J + 1: IF J < 13 THEN 620
640  GOTO 550
650 I = J: IF I > 6 THEN I = 262 - I
660  GOSUB 820: GOTO 540
670  POKE 251,R: POKE 252,C
680 J = 16285 + 10 * R + C:K =  PEEK (J
     )
690  IF I = 141 THEN 740
700  POKE 8,7: CALL 24576
710  FOR J = 0 TO 30: NEXT J
720 I = K: GOSUB 850
730  FOR J = 0 TO 60: NEXT J: GOTO 550
740  IF F THEN 790
750  IF K = 0 OR K > 6 THEN 550
760 F = 1:R1 = R:C1 = C: CALL  - 198
770  IF  PEEK ( - 16368) = 141 THEN 770
780  GOTO 550
790 R2 = R:C2 = C:R = R1:C = C1:I = 0
800 K =  PEEK (16285 + 10 * R + C): GOSUB
     820
810 R = R2:C = C2:I = K
820  IF R = 0 AND I = 255 THEN I = 251
830  IF R = 7 AND I = 1 THEN I = 5
840  POKE 16285 + 10 * R + C,I
850  IF I > 6 THEN I = 384 - I
860  IF B$ = "1" OR I = 0 THEN 890
870  IF I > 6 THEN I = I - 256
880 I = I + 128
890  POKE 251,R: POKE 252,C: POKE 8,I: CALL
     24576: RETURN
900 K = 7:M = 3:L = 30
910  FOR J = 0 TO K: FOR I = 0 TO 4: POKE
     B(I) + M + J,C(L):L = L + 1: NEXT
     I: NEXT J: RETURN
920  DATA 4,2,3,5,6,3,2,4,7,7,1,1,1,1,1
     ,1,1,1,7
930  DATA 7,0,0,0,0,0,0,0,0,7,7,0,0,0,0
     ,0,0,0,0,7
940  DATA 7,0,0,0,0,0,0,0,0,0,7,7,0,0,0,0
     ,0,0,0,0,7
950  DATA 7,255,255,255,255,255,255,255
     ,255,7
960  DATA 7,252,254,253,251,250,253,254
     ,252
970  DATA 160,208,206,194,210,209,203,1
     44,142,130,146,145,139
980  DATA 19,21,19,21,115,68,42,46,42,7
     4,21,20,12,20,21
990  DATA 85,85,119,87,85,100,68,68,68,
     68,29,4,12,4,28
1000  DATA 72,40,72,8,104,1,64,64,65,0,
     43,40,56,40,43,103,17,19,17,103
1010  DATA 42,106,102,42,42,73,21,29,21
     ,21,59,9,25,9,57,35,37,37,5,35
1020  DATA 165,251,69,252,41,1,133,48
1030  DATA 32,19,96,166,8,208,1,96
1040  DATA 232,134,48,165,48,41,15,168
1050  DATA 185,170,96,133,6,185,179,96
1060  DATA 133,7,169,0,133,9,164,251
1070  DATA 185,162,96,133,254,165,252,1
     0
1080  DATA 10,24,121,154,96,133,253,32
1090  DATA 75,96,165,253,24,105,128,133
1100  DATA 253,165,254,56,233,32,133,25
     4
1110  DATA 76,75,96,32,90,96,165,254
1120  DATA 24,105,4,133,254,201,96,48
```

```
1130  DATA 242,96,169,3,133,25,164,48
1140  DATA 240,41,136,240,38,16,19,164
1150  DATA 9,177,6,230,9,73,255,164
1160  DATA 25,49,253,145,253,198,25,16
1170  DATA 238,96,164,9,177,6,230,9
1180  DATA 164,25,17,253,145,253,198,25
1190  DATA 16,240,96,164,9,177,6,230
1200  DATA 9,164,25,145,253,198,25,16
1210  DATA 242,96,84,84,44,44,44,44
1220  DATA 4,4,65,64,67,66,65,64
1230  DATA 67,66,188,252,60,124,188,252
1240  DATA 60,124,188,96,96,97,97,97
1250  DATA 97,98,98,98
1260  DATA 0,0,0,0,213,170,213,170,213,
      170,213,170,213,170,213,170
1270  DATA 213,170,213,170,213,170,213,
      170,213,170,213,170,213,170,213,17
      0
1280  DATA 213,170,213,170,213,170,213,
      170,213,170,213,170,213,170,213,17
      0
1290  DATA 213,170,213,170,213,170,213,
      170,213,170,213,170,213,170,213,17
      0
1300  DATA 0,0,0,0,42,85,42,84,42,85,42
      ,84,42,85,42,84
1310  DATA 42,85,42,84,42,85,42,84,42,8
      5,42,84,42,85,42,84
1320  DATA 42,85,42,84,42,85,42,84,42,8
      5,42,84,42,85,42,84
1330  DATA 42,85,42,84,42,85,42,84,42,8
      5,42,84,42,85,42,84
1340  DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,3,
      96,0
1350  DATA 0,15,120,0,0,15,120,0,0,3,96
      ,0,0,15,120,0
1360  DATA 0,3,96,0,0,3,96,0,0,15,120,0
      ,0,63,126,0
1370  DATA 0,63,126,0,0,0,0,0,0,0,0,0,0
      ,0,0,0
1380  DATA 0,0,0,0,0,0,0,0,0,0,1,64,0,0
      ,7,64
1390  DATA 0,0,127,64,0,15,127,112,0,63
      ,126,48,0,63,127,112
1400  DATA 1,127,127,112,1,127,127,124,
      7,127,103,124,7,127,96,48
1410  DATA 7,127,120,0,7,127,126,0,7,12
      7,127,64,0,0,0,0
1420  DATA 0,0,0,0,0,0,0,0,0,60,30,0,0,
      60,30,0
1430  DATA 1,124,127,64,1,115,127,64,1,
      79,127,64,1,79,127,64
1440  DATA 0,63,126,0,0,48,6,0,0,63,126
      ,0,0,48,6,0
1450  DATA 7,127,127,112,31,124,31,124,
      24,0,0,12,0,0,0,0
1460  DATA 0,0,0,0,0,0,0,0,3,103,115,96
      ,3,103,115,96
1470  DATA 3,127,127,96,0,96,3,0,0,127,
      127,0,0,127,127,0
1480  DATA 0,127,127,0,0,127,127,0,0,12
      7,127,0,0,96,3,0
1490  DATA 3,127,127,96,15,127,127,120,
      15,127,127,120,0,0,0,0
1500  DATA 0,0,0,0,0,0,0,0,0,48,24,0,0,
      48,24,0
1510  DATA 96,48,24,12,97,124,128,12,25
      ,124,126,48,25,124,126,48
1520  DATA 31,127,127,112,6,0,1,64,7,12
      7,127,64,7,124,127,64
1530  DATA 7,127,127,64,6,0,1,64,7,127,
      127,64,0,0,0,0
1540  DATA 0,0,0,0,0,63,120,0,0,51,24,0
      ,30,60,121,112
1550  DATA 127,115,31,124,127,127,127,1
      24,127,112,31,124,31,124,127,112
1560  DATA 31,127,127,112,6,0,1,64,7,12
      7,127,64,7,124,127,64
1570  DATA 7,127,127,64,6,0,1,64,7,127,
      127,64,0,0,0,0
```


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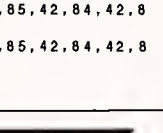

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Muppet Roundup

Fred D'Ignazio, Associate Editor

This month we're going to take a look at three computer products for children, all associated with the Muppets, that lovable gang of characters invented by Jim Henson and Associates in New York.

The first product we'll examine is the Muppet Learning Keys, codeveloped by Christopher Cerf of Henson Associates, Koala Technologies (which makes the popular KoalaPad), and Sunburst Software, one of the foremost educational software publishers. The keys cost $80 and plug into the joystick socket on your Commodore 64 or Apple computer.

Muppet Learning Keys is intended for children age three and up. But it is not just for children. If someone is intimidated by computers and mystified by the computer's keyboard, then the Muppet Keys may be just the thing—at least to get started. The keys are large buttons with big, easy-to-read letters, numbers, words, and colorful pictures of the Muppets. They are easy to use regardless of the shape or size of your fingers.

The alphabet keys are arranged alphabetically, not in the mysterious QWERTY order you see on typewriter and computer keyboards. Next to these keys is a paint box to change colors on the screen. There is an Eraser to erase the picture on the screen. There is a Help key, in case you are lost and need help. There is an Oops key that lets you undo a mistake. There is even a Zap key you can punch when you are tired of playing a game and you want to go back to the main menu and select a new game.

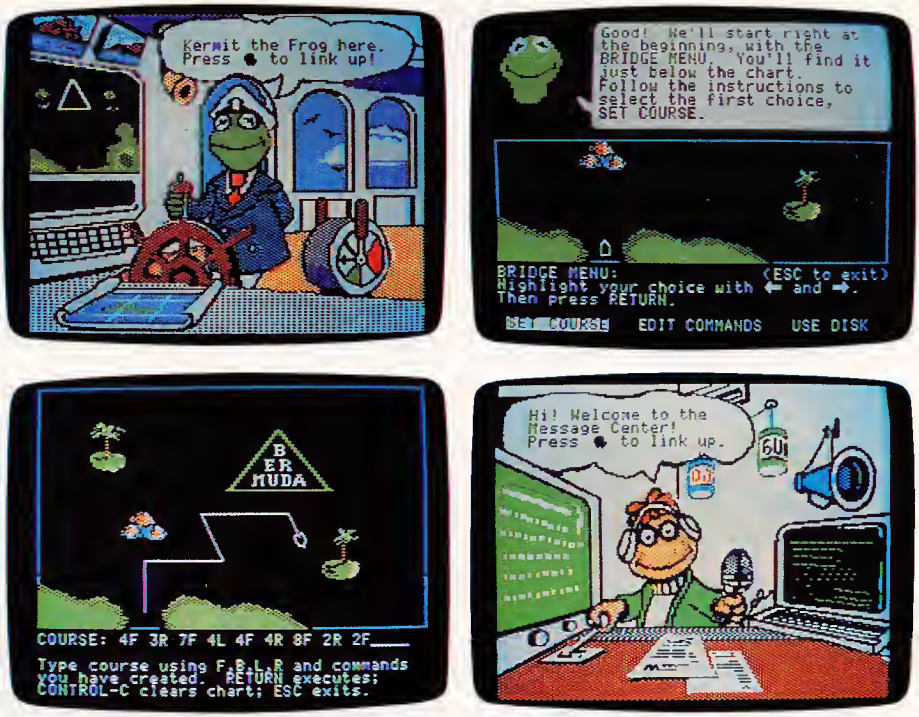
Koala Technologies' Muppet Learning Keys is an auxiliary computer keyboard especially suited for young children.

Like other touch pads on the market, Muppet Learning Keys comes with software on disk. More software is planned for additional activities. However, the important thing to remember is that this is not just a new application or software product for your computer. It is a new keyboard for the computer—especially suitable for children and beginners. Already, some of the most prestigious software publishers are designing new games and educational programs for this keyboard.

However, since it's a new product, the only thing that works with it now is the Muppet disk from Koala Technologies. This might influence you to postpone buying the product until more software becomes available. Also, you might

Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. His books include Katie and the Computer *(Creative Computing),* Chip Mitchell: The Case of the Stolen Computer Brains *(Dutton/Lodestar),* The Star Wars Question and Answer Book About Computers *(Random House), and* How To Get Intimate With Your Computer (A 10-Step Plan To Conquer Computer Anxiety) *(McGraw-Hill).*

As the father of two young children, Fred has become concerned with introducing the computer to children as a wonderful tool rather than as a forbidding electronic device. His column appears monthly in COMPUTE!.



Some sample screens from Brøderbund Software's Welcome Aboard! The Muppets Cruise to Computer Literacy, *an educational program for youngsters.*

wonder if it's worth paying $80 for an additional keyboard with pictures of Muppets, paintbrushes, compasses, and rulers. Wouldn't kids be better off using real rulers and real paintbrushes instead of imaginary ones on a computer?

This seems like a good question—until you have seen a young child or a computerphobic adult approach a computer keyboard for the first time. Usually they're frozen into inaction by the bewildering number of keys and the strange symbols. Muppet Learning Keys offers an attractive alternative to the standard keyboard. It is a beginner's keyboard—familiar, colorful, and inviting—and both children and adults warm up to it quickly.

The Muppet Institute Of Technology

The Muppet Institute of Technology (or "M.I.T.") was endowed by Simon & Schuster to offer early learning courses to children who use microcomputers. The Institute is the whimsical creation of Frank Schwartz of Simon & Schuster's Electronic Publishing Division. It doesn't charge a price for its software; it charges tuition. And in every package, children who complete the imaginary course are awarded a diploma and course credits.

The first two products come from the Institute's Reading Department and are intended for children ages four to eight. Each costs $40 and will be available for the Commodore 64 at the end of the year, and for the Apple early in 1985. In *The Great Gonzo in Word Rider,* Gonzo's favorite chicken, Camilla, has been kidnapped and carried away into the mountains. Children go on a quest with Gonzo to rescue Camilla. They have to survive several hazards on the journey. On the way, they construct vehicles that allow them to make it safely through the hazards. The vehicles are fanciful—like Gonzo's Rolling Hornblower. Yet they are also logically suited for the particular hazard the child must overcome. On the way to rescuing poor Camilla, children gain skills in reading, vocabulary, word usage, problem solving, and elementary logic.

In the second program, *Kermit's Electronic*

Finally, a Computer Keyboard Kids Can Use

A computer can help your child learn, but the keyboard often gets in the way. It's a jumble of keys that's confusing and hard for little fingers to operate. And it's not much fun.

Introducing Muppet Learning Keys™ from Koala Technologies™

It's the first computer keyboard made especially for young children. Unlike regular computer keyboards, all the letters and numbers are in order. So a child can find A-B-C and 1-2-3 without hunting all over the keyboard. And with Muppet Learning Keys software, learning letters and numbers becomes fun.

From the Experts

Muppet Learning Keys was created by education specialists to make learning exciting for your child. It's the first computer keyboard with Kermit, Miss Piggy and the whole Muppet gang right on it, ready to introduce your children to the magic of letters, numbers and colors.

© Henson Associates, Inc., 1984

Kid Stuff

Muppet Learning Keys has things that every child knows and loves:

- A paint box with eight touchable colors
- A blackboard with the ABC's in order
- A ruler with the numbers where they're supposed to be
- And keys the right size for small fingers

Press any key and something always happens. Press K and Kermit flies his kites. Press 6 and six kites appear. Touch a button on the paint box and leave a colorful impression.

Muppet Learning Keys–for a child's hands, a child's mind and a child's heart. Give your child Muppet Learning Keys and make computer learning child's play.

Muppet Learning Keys. The Hands-on Keyboard for Kids.

Jim Henson's Muppet Learning Keys™

For the Apple® IIe and IIc, Atari,® and Commodore 64™ computers. In-Box software by Sunburst Communications. Muppet Learning Keys works with software that is designed or adapted for it.

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Koala Technologies Corporation

Storymaker, children build stories using nouns, verbs, and prepositions, plus Muppets, locations of Muppets, and Muppet actions. For example, children can place Miss Piggy in a desert and make her fly, or they can set Kermit spinning under the ocean. Children learn new words as they build their stories. Then they can make the computer display their stories, like a slide show, and save the stories on disk so they can read them later.

Welcome Aboard! The Muppets Cruise To Computer Literacy

The third Muppet computer product, *Welcome Aboard! The Muppets Cruise to Computer Literacy,* comes from Henson Associates and Brøderbund Software and costs about $40. This is another product, like the Muppet Learning Keys, that is ideal both for children age five and up and for all computer beginners.

You begin your voyage with the Muppets by viewing a cross section of their ship on the computer screen. The picture of the ship is really a disguised menu. You can choose different activities by pressing the arrow keys to position a small anchor in any of the rooms, including a Message Center, Computer Room, Joke Library, Salon de Beauté, Game Room, and the Bridge.

The beauty of *Welcome Aboard!* is that on the surface you're playing make-believe games with the Muppets, while actually you are learning about important computer applications, such as using the computer as an electronic typewriter, post office, and file cabinet. You are learning how to create computer pictures, or graphics, and how to program the computer. And, most importantly, you are learning to take control of the computer and use it as a tool to accomplish meaningful goals.

In the Message Center, for example, you don't just write letters. Instead, you send messages to the crew of the Muppet boat, and then they send messages back to you. You can choose to edit the messages or save them on disk for later reference. On the Bridge, you use a Logo-like Muppet programming language called Slowgo to pilot the Muppets' ship across the treacherous sea to its goal—either Pig Island or Frog Island.

In the past, I've been a major critic of teaching children how to program in regular computer languages such as Logo or BASIC because I feel that programming has little meaning to a child, and it has little practical use in the child's world. In *Welcome Aboard!,* however, both of my criticisms have been at least partly answered. Children program the computer to help the Muppets navigate a boat (a practical task), and to help them reach their destination without sinking (a meaningful objective).

Worthwhile Products

Many of the computer products on the market for children suffer from the same maladies. Either they are trivial copies of activities children would be better off doing with paper, scissors, glue, modeling clay, and fingerpaints, or they are cheap commercial spinoffs of popular products in other media—software Smurfs, superheroes, and Barbie dolls. Or they are so insipid and uninspired that adults avoid them and children quickly get bored with them.

But the Muppet products are a pleasant surprise. They are charming, educational, and practical. They are equally attractive to children and adults. They take characters which are successful in other media—on TV and in the movies—and bring them to life on the computer "stage." They teach fundamental skills such as how to use a computer, how to read, plan, and reason logically, and they do it not by dull, rote drill, but with exciting adventures, like rescuing other creatures, piloting a ship across hazardous straits, and communicating with other creatures. These products teach computing not as a science or hobby, but as a tool to accomplish practical goals and to help other people.

However, the key ingredient in all these products is missing if you plop your child in front of the computer and walk away. The ingredient does not come packaged inside the boxes and it's not found inside any computer. The key ingredient is your attention. If you and your child use these products together, the experience will be far richer and more valuable for both of you than if you use them alone.

For More Information

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39 Washington Avenue
Pleasantville, NY 10570

Simon & Schuster Electronic Publishing Group
Simon & Schuster Building
1230 Avenue of the Americas
New York, NY 10020

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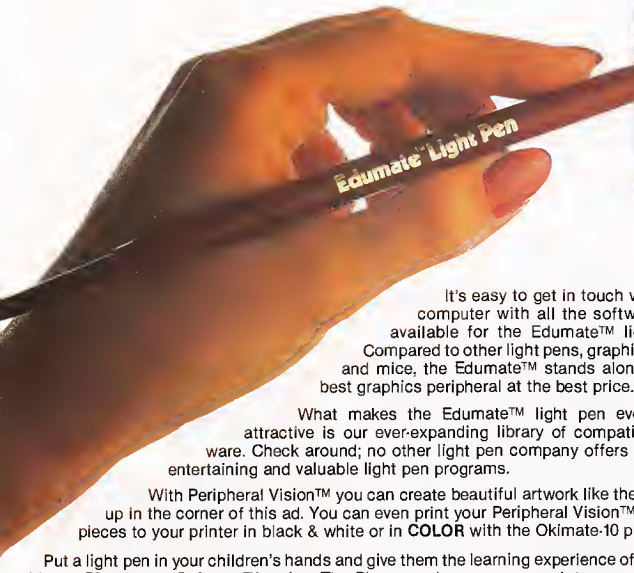
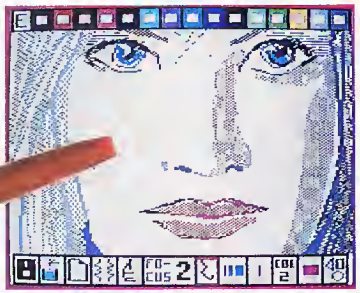
17 Paul Drive
San Rafael, CA 94903

how to really get in touch with your computer.





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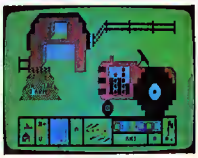

Animal Crackers

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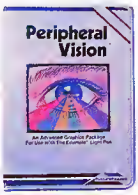

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THE BEGINNER'S PAGE

Tom R. Halfhill, Editor

Learning To Program

Too many people who first begin using a computer are overwhelmed at the idea of learning how to program. It's hard to blame them. For years people have been led to believe that programming is an obscure and extremely difficult task, something best left to scientists, mathematicians, and technicians. Like nuclear physics, it was supposed to be far beyond the reach (and interests) of ordinary people.

By now we should know better. Not only have thousands of everyday people learned how to program, but some of the best programmers have turned out to be people who are too young to vote or even drive a car. Millions of grade-school children are pecking away at computer keyboards and programming while they're still learning the traditional three R's.

So if little kids can program, what's to stop anyone else?

Some people fear they can't learn to program because they've always been bad at math. But actually, programming has little to do with higher mathematics—unless, of course, you want to write programs that employ higher mathematics. For the most part, plain old addition, subtraction, multiplication, and division are all you'll need to know. You can write a program which calculates mortgage payments even if you can't tell trigonometry from a tyrannosaur.

Other people are discouraged by the complexity of learning a computer programming language. Yet, computer languages—such as BASIC, Logo, Pascal, FORTRAN, or even machine language—are far easier to tackle than human languages. All human languages have vocabularies consisting of tens of thousands of words, plus thousands more variations of words. And the grammatical rules for putting those words together into meaningful phrases are tricky and complicated. But practically all computer languages have vocabularies of less than 100 words, often closer to 50. Only about half of those words are used in everyday programming, and the rules of syntax are more rigidly defined. What's more, if you inadvertently break the rules, the computer tells you so and even gives you a clue about the nature of your error. (If only it were that easy to learn how to conjugate irregular verbs in French!)

Still, many people have a hard time with programming. Part of the problem may be that they're spending too much time learning all the commands and syntax rules instead of figuring out how to solve the problem they're working on. This is like learning by rote the vocabulary words of a foreign language without actually linking them together into sentences to express your thoughts. It's fairly easy to learn what the GOTO command does in BASIC, for example, but figuring out when to use it may be less obvious.

That's why many programming instructors favor a different approach to learning how to program—a *problem-solving* or *algorithm-based* approach rather than a language-based approach. In other words, once you learn the basic ways of solving problems on a computer, you just apply the vocabulary and syntactical rules of whatever language you're using and write your program.

In practice, it's a *little* more difficult than that—some languages are structured quite differently than others in order to make them more suitable for certain tasks, or to reflect a certain philosophy (the nearly GOTO-less structure of Pascal, for instance). But the basic approach holds true. Once you know how to solve problems in one computer language, it's relatively easy to apply your knowledge to other lan-

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guages. The key is to learn the basics of problem-solving on a computer.

A Computer In Your Mind

To a large degree, your skill at programming depends on how well you can learn to think like a computer yourself. This might sound strange, but there's nothing hard about it at all. At their present state of technology, computers are rather simple "thinkers." They only seem so smart sometimes because they perform their simple thinking so rapidly—much faster than we mere humans.

However, any computer program—no matter how sophisticated it appears when it's running—is essentially just a list of instructions. The computer follows the instructions one at a time, in the order specified by the programmer. If you, a human, performed these same instructions in the same order, your results would be the same as the computer's (although it would probably take you longer, of course). There's nothing theoretical about this, because that's exactly how the programmer wrote the program. The programmer started out by defining the problem, conceiving a way of solving the problem, and then giving the computer a list of step-by-step instructions so it could find the solution.

Notice that only the third step involves actually programming the computer. Although many people think it's the major step, it might actually be a minor part of the process. The first two steps often demand the most skill and creativity. In fact, major software developers these days often employ teams of "programmers." The senior members of the team concentrate on defining the problem and constructing a method of finding the solution. Then they assign the task of coding the instructions in a computer language to the junior programmers. The senior programmers, or *program designers*, may never touch a computer keyboard.

Whether a team is involved or only one programmer, the process is the same. You can't program a computer to solve a problem until you first know how to solve it yourself. Not that you have to actually arrive at the solution—that's the computer's job. Your job is to encode the *method of finding the solution* into instructions the computer can understand and carry out. And to do that, you have to comprehend how the computer will interpret each instruction you give it before going on to the next instruction. You have to learn how to think like the computer.

How Computers Think

As we said above, learning to think like a computer isn't really very hard because computers right now are pretty simple-minded thinkers. They always think logically and sequentially. On their own, they aren't capable of illogical thinking, emotion, or leaps of insight. The fact is, they're utterly predictable. Even their randomness is the product of carefully simulated disorder. Their behavior is a lot easier to figure out than that of most people, which is why some obsessive programmers withdraw from the world and spend all their time programming.

Let's try an example. Assume you're a schoolteacher who wants to calculate a student's grade based on five test scores.

The first step is to define the problem. That seems easy: You just want to figure out a letter grade based on five numeric scores. But do all the scores carry the same weight? Were some tests more important than others? And how many points will it take to earn an A instead of a B?

To keep things simple for this example, let's say all the scores carry the same weight. Therefore, you need to calculate the *mean average* of the five scores. To translate the result into a letter grade, you'll use the following scale: 95–100 points is an A, 85–94 points is a B, 75–84 points is a C, 65–74 points is a D, and 0–64 points is an F.

Now that you've defined the problem, the second step is to figure out how to find the solution. Some people, especially when first learning how to program, work this out on paper before sitting down at the computer. There's even a formal way of doing this, called *flow charting*. It's similar to diagramming a sentence in English, except the object of flow charting is to figure out how to construct the program in the first place rather than analyzing the structure of an existing program.

We won't get into formal flow charting here, but we can do the same thing by drawing up a simple outline. Here's how we might tackle our sample problem:

A. Calculate the mean average of the five test scores.
   1. Add the five scores together and remember the sum.
      a. Add the first test score to the second test score.
      b. Add the result of the previous calculation to the third score.
      c. Add the result of the previous calculation to the fourth score.
      d. Add the result of the previous calculation to the fifth score.
      e. Store the final sum for later use.
   2. Divide the sum by the number of test scores.

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a. Take the sum of the scores as calculated above and divide them by five.
b. Store this result, the mean average, for later use.

B. Translate the average score into a letter grade.
1. Take the average score as calculated above and compare it to the grading scale.
   a. Is the score somewhere between 95 and 100? If so, then the grade is an A.
   b. Is the score between 85 and 94? If so, then the grade is a B.
   c. Is the score between 75 and 84? If so, then the grade is a C.
   d. Is the score between 65 and 74? If so, then the grade is a D.
   e. Is the score less than 65? If so, then the grade is an F.
2. Give the result of the calculations by revealing the final letter grade.

Writing The Code

Whether you realize it or not, we've actually written a program. We've compiled a list of step-by-step instructions which, if followed exactly, will yield the solution to our problem. You could take this list and solve the problem yourself, right now, with pencil and paper or a pocket calculator. The only thing that's required besides the list is some knowledge of simple addition and division, plus the actual data (the test scores). You've already done the hard part; you've concocted the recipe. Now the problem can be solved by anyone who's capable of following instructions and handling sixth-grade arithmetic, whether he's a genius or an idiot.

In this case we'll submit the problem to an idiot—the computer. You don't have to worry about the computer jumping to an illogical conclusion or arriving at a wrong answer. As long as you do your job—give the right instructions to the computer in the proper order and in a language it can understand—the computer will do exactly what you say. It's not smart enough to disobey or come up with its own solution to the problem. It can't appear to be any more intelligent than its programmer.

At this point you could encode the instructions—that is, write the actual program—in any one of dozens of computer languages. BASIC, Pascal, PILOT, Logo, FORTRAN, machine language—the results will be the same. Which one should you choose? The decision is based on a number of factors: which language is best-suited to this type of problem; which language will give the fastest results; which language is easier to use; which language is readily available for your computer; and so on.

Since virtually all personal computers have some form of BASIC built-in, we'll write the sample code in BASIC. But it's important to realize that the program could be written more or less as well in any computer language.

Now let's see how the program might look. Keep in mind that this is a generalized example; because of variations between the BASICs built into various computers, it may require modifications to run on your particular computer (see the notes following the listing). Also, we'll explain the meaning of some special symbols and terms at the end of the listing. Comments explaining sections of the program are printed in italics.

[Store the five test scores in variables.]

```
10 TEST1=84 TEST2=76 TEST3=92 TEST4=88
TEST5=68
```

[Add the test scores together and store the sum in a variable.]

```
60 TESTSUM=TEST1+TEST2+TEST3+TEST4+
TEST5
```

[Find the mean average by dividing the sum by the number of test scores.]

```
70 AVERAGE=TESTSUM/5
```

[Compare the average score to the grading scale to translate it into a letter grade.]

```
80 IF AVERAGE>=95 AND AVERAGE<=100
  THEN GRADE$="A"
90 IF AVERAGE>=85 AND AVERAGE<=94 THEN
  GRADE$="B"
100 IF AVERAGE>=75 AND AVERAGE<=84
  THEN GRADE$="C"
110 IF AVERAGE>=65 AND AVERAGE<=74
  THEN GRADE$="D"
120 IF AVERAGE<65 THEN GRADE$="F"
```

[Tell the result of running the program—the student's final letter grade.]

```
130 PRINT "THE STUDENT'S GRADE IS ";GRADE$
```

Analyzing The Program

If you compare the outline we prepared with the program listing, you'll see how closely they correspond. They're both linear and logical. The hard work, indeed, was in defining the problem and designing the method of solution. The actual coding or programming was almost an anticlimax. Even if you've never programmed in BASIC, you should be able to deduce what the program is doing by consulting a BASIC programming manual. To save you some time, here's what some of the special symbols and terms mean:

A *variable* is a way of storing a number in a program. The statement TEST1=84 assigns the number 84 to the variable TEST1. In effect, the variable becomes the number. The rules for using

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variables differ on various computers; on Commodore and Apple computers, for example, only the first two letters of a variable matter, so the computer couldn't distinguish TEST1 from TEST2. (Try T1 and T2 instead.)

Variables that end with a dollar sign ($) are *string variables*. Instead of storing numbers, they store strings of characters. In this program, we used GRADE$ to store the character of the letter grade (A, B, C, D, or F). Some forms of BASIC, such as Atari BASIC, require you to define the maximum number of characters a string variable will hold before using the string variable, so you'd need to add a statement like **15 DIM GRADE$(1)**.

In BASIC, the arithmetic operators are + for addition, − for subtraction, * for multiplication, and / for division. Thus, the statement **AVERAGE=TESTSUM/5** in line 70 divides the variable TESTSUM by 5 and assigns the answer to the variable AVERAGE.

In BASIC, the symbol <= means *less than or equal to* and the symbol >= means *greater than or equal to*. Therefore, a statement like **IF AVERAGE>=75 AND AVERAGE<=84 THEN GRADE$="C"** in line 100 means, "If the average test score is between 75 and 84, then the letter grade is a C." In line 120, rather than checking to see if the average score falls between 0 and 64, the program just assigns an F if the number is anything less than 65.

Line 130 tells us the result by printing the answer on the screen. If the result is a B, the program prints THE STUDENT'S GRADE IS B.

As you can see, the program structure is pretty straightforward. Certainly more complex problems demand more complex programming. But trying to learn how to program just by memorizing all the commands in a language is like learning how to speak French just by memorizing vocabulary words. You won't become fluent until you actually begin linking the words together to express thoughts—the very purpose of a human language. And you won't become a fluent programmer until you start designing solutions to problems and expressing the solutions in programming commands—the purpose of a computer language.

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Although computers which lack full-screen editing usually let you make changes to BASIC lines without retyping them entirely, the process is a little more tedious. Often you have to memorize special editing commands and key sequences. Sometimes, however, utility programs are available which enhance the computer's built-in editing capabilities. ©

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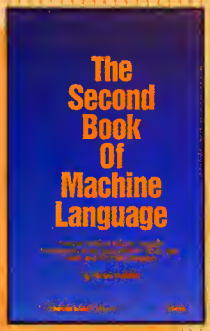

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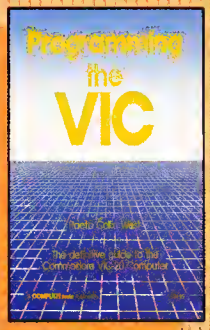

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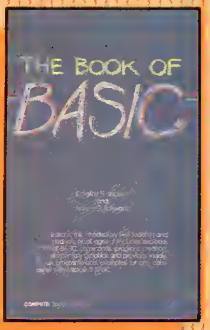

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64 Paintbox

Chris Metcalf

One of the most powerful features of the Commodore 64 is its high-resolution color graphics. But like any powerful, versatile system, it can be difficult to learn and use. This program makes it easy. Atari computers have an efficient set of graphics commands, and "64 Paintbox" now makes them available on the 64 as well. You can plot points, set colors, or draw lines with just one statement. You can even type in programs originally written for Atari graphics modes 7 and 8 on your 64.

The Commodore 64 is an undeniably powerful computer; its capabilities in high-resolution color graphics, for example, surpass those of the Atari and Apple computers. Nonetheless, it takes time to calculate the POKEs and PEEKs required to access these graphics. Also, the resulting program will likely be fairly slow. This graphics program, "64 Paintbox," takes Atari's far more powerful command set and makes it available to the Commodore 64 user.

BASIC programs written for Atari graphics modes 7 and 8 can be transferred to the Commodore 64 with 64 Paintbox. You can type in an Atari program, line by line, adding an exclamation mark (!) before each graphics command to let the 64 BASIC interpreter know that it is a special command.

Entering 64 Paintbox

To enter Program 1, 64 Paintbox, you first need to load and run the MLX program found elsewhere in this issue. MLX makes it easy to type in a machine language program like 64 Paintbox and insures you'll have a working copy the first time. Once you've run MLX, it asks for two addresses. They are:

```
Starting address: 49152
Ending address: 51197
```

Now you can begin typing in Program 1. When you're through, save it to tape or disk, using the filename *64 Paintbox* if you want to use the loader program (Program 2) to load it in.

Load 64 Paintbox by entering:

```
LOAD"64 PAINTBOX",8,1 (for disk)
LOAD"64 PAINTBOX",1,1 (for tape)
```

Then type

```
SYS 49152:NEW
```

to initialize the program and reset the pointers. To simplify loading the program, you may use Program 2. Use the Automatic Proofreader program to type in this short autoload routine. Save it on the same disk as 64 Paintbox. (If you're using tape, Program 2 should precede 64 Paintbox on the 8 is a 1.) Type LOAD"PROGRAM 2",8 (or just LOAD"PROGRAM 2" if you've got a Datassette) and RUN; the program will display the command set, load in 64 Paintbox, initialize 64 Paintbox, and execute a NEW. At that point, you can start entering Atari programs.
can start entering Atari programs.

No matter which method you use to load 64 Paintbox, the Atari graphics commands are easy to use. Each command must be preceded by an exclamation mark (and a colon, if following an IF-THEN statement). The command name can be spelled out in full, or abbreviated with a period as on the Atari. However, these abbreviations are *not* expanded when the program is listed. The various parameters follow the command name. Thus a typical syntax might be:

```
!PLOT 100,100
```

to plot a point at 100,100.

As with normal BASIC commands, spaces are ignored, whether in the command name or in the parameters.

Since the 64 Paintbox commands are not standard BASIC, the IF-THEN routine will not recognize them as being legal commands unless they're preceded by a colon. Imagine, for example, that you want to plot a point where there is no point already. Here's how:

```
!LOCATE 10,15,A : IF A = 0 THEN: !COLOR 1 :
!PLOT 10,15
```

64 Paintbox Commands

The commands themselves are as follows (abbreviations are enclosed within parentheses):

- **!GRAPHICS n (!G.)** This command is identical to the Atari GRAPHICS command, and takes only one parameter, *n*, the graphics mode. Since only graphics modes 7 and 8 are supported,

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all graphics commands between 1 and 6 are treated as if they were 0. As with the Atari, either 7 or 8 may have 16, 32, or 48 added to it. Plus 16 gives no text window; +32 does not clear the graphics screen; and +48 combines the two. Without any of these extra numbers (just !GRAPHICS 8, for instance), the graphics screen will clear, and a four-line text window will be set up at the bottom. Regardless of the additional numbers, however, the screens will always be reset to standard Atari graphics colors.

Do not try to use tape or disk with the text window enabled. For example, if you enter LOAD and hit RUN/STOP, the interrupts will be partially disabled, and you will need to reenter the graphics mode (with +32). Attempted disk access will return a ?DEVICE NOT PRESENT ERROR.

The Atari does not allow plotting to the area "under" the text window, but 64 Paintbox does, although the graphics remain concealed until you view what you have done with a !GRAPHICS n+48 where n is 7 or 8. Furthermore, when working with the graphics screen in immediate mode, 64 Paintbox does not need a text window, as the Atari itself does.

• **!PLOT x,y (!P.)** This is the PLOT command; x and y are offset from the top left corner of the screen, and have a range of 0–319 for x and 0–199 for y in graphics mode 8. In GRAPHICS 7, the ranges are 0–159 for x and 0–99 for y. The command is not set up to work in graphics mode 0. The PLOT command plots in the current color register (see the SETCOLOR and COLOR commands). PLOT also sets the starting point for the DRAWTO command.

• **!POSITION x,y (!PO.)** The POSITION command sets the starting point for the DRAWTO command without actually altering the display. The x and y values are the same as in the plot command. This command, like plot, positions the graphics screen "cursor" (not the actual text cursor), regardless of the graphics mode.

• **!DRAWTO x,y, (!DR.)** This command, DRAWTO, draws a line connecting the old starting point to the specified x,y, using the current color register, and then sets the starting point for the next DRAWTO to the specified x,y. The x,y parameters have the same range as for plot and position. This command does not affect the screen in GRAPHICS 0.

• **!SETCOLOR r,c1,c2 (!S.)** The SETCOLOR command changes the specified r register to hue (c1) and luminance (c2) in the range 0–15. The format is identical to that of the Atari. The various registers set the colors of the border, the background, the characters, and the pixels according to Table 1. Note that bit-pairs (00, 01, 10, and 11) are used to define single pixels in graphics mode 7. The number above is the graphics register r (the first parameter).

Table 1: SETCOLOR r Values

GRAPHICS 0	GRAPHICS 7	GRAPHICS 8
0 ———	01 pair pixels	———
1 Characters	10 pair pixels	Characters/pixels
2 Background	11 pair pixels	Background
3 ———	———	———
4 Border	5creen color	Border

An unfortunate problem with the way the 64 and the Atari are configured is that, in graphics mode 7, the 64's character color in the window is set by SETCOLOR register 2, not 1, and that the text window cannot be set to its own color. Instead, it takes on the color of the rest of the screen.

Another problem with register 2 in graphics mode 7 is that this register is set to the background color (or white on old 64s) whenever the screen is cleared. Thus, printing the "clearscreen" character when in graphics mode 7 (even with no window) must be avoided. All 11 pixel pairs would become background color: in other words, invisible. Furthermore, any scrolling of the text window in GRAPHICS 7 will scroll strange color data into the 11 pixel pairs. This is, however, no problem in graphics mode 8.

You may be interested to know that executing a !SETCOLOR 2,c1,c2 in GRAPHICS 7 or a !SETCOLOR 1,c1,c2 in GRAPHICS 8 causes the character color register at 646 to be set to colors

Table 2: Matching Atari Hue And Luminance To 64 Paintbox Color Codes

Hue \ Luminance	0	2	4	6	8	10	12	14
0	0	11	11	11	12	12	15	1
1	0	12	7	7	7	7	1	1
2	0	2	8	8	8	8	15	15
3	0	9	2	2	2	2	8	8
4	0	9	2	2	2	2	8	8
5	0	6	6	6	4	4	4	4
6	0	6	6	6	4	4	4	4
7	0	6	6	6	14	14	14	14
8	0	6	6	6	14	14	14	14
9	0	6	14	14	14	14	3	3
10	0	6	14	14	5	5	13	13
11	0	6	14	14	5	5	13	13
12	0	5	5	5	5	5	13	13
13	0	5	5	5	13	13	7	7
14	0	8	8	8	5	5	13	13
15	0	8	8	8	10	10	10	10

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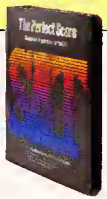
Harcourt Brace Jovanovich COMPUTER SAT	FEATURES	Computer preparation for the SAT THE PERFECT SCORE
Two double-sided	Number of disks	Six double-sided
Yes!	Testing and learning modes	Yes!
Yes!	Sample test	Yes!
No	Practice SAT and TSWE on disk	Yes!
Yes!	Manual with test taking strategies	Yes!
No	Continuous on-screen clock	Yes!
No	Print-out capability	Yes!



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No	Keyboard on-screen. Correct finger position on screen. High resolution graphics	Yes!
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Yes!	Multiple levels	Yes!
No	Based on Successful typing procedure	Yes!
No	Timed paragraph typing test	Yes!
No	Drill on weakest characters	Yes!
No	Progress recorded	Yes!

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c1,c2. Thus, previous color codes are disregarded when a !SETCOLOR or !GRAPHICS command is executed (!GRAPHICS calls !SETCOLOR to set up default colors).

The numbers (0–15) that you can use for c1 and c2 in SETCOLOR *do* correspond to various color and luminance settings on the Atari. Take a look at Table 2 to see what values in 64 Paintbox match Atari's hue and luminance values.

● **!COLOR r (!C.)** This command specifies which color register (given above for !S.) is to be used for plotting and line drawing. In both graphics modes, 0 has the same effect: It erases pixels. In GRAPHICS 8, an odd number for *r* always sets the computer to plot pixels. Registers 1–3 are used in GRAPHICS 7, where register 1 sets bit-pair 01, 2 sets 10, and 3 sets 11 (note that this is the SETCOLOR number plus one).

● **!LOCATE x,y,v (!L.)** The LOCATE command returns (in floating-point variable v) the pixel currently at location x,y and sets the starting point for DRAWTO to the LOCATEd pixel. Thus, for GRAPHICS 8, either a zero (no pixel) or a one (pixel present) is returned. In GRAPHICS 7, a zero also indicates no pixel, while one to three correspond to bit-pairs 01, 10 and 11. Using the LOCATE command with a non-floating-point variable does nonproductive (though interesting) things, so it's best to stick to floating-point variables. That is, use no % (integer variable) or $ (string variable) symbols after a variable.

● **!FILL x,y (!F.)** This command is a more powerful version of the Atari XIO fill command. It will fill any area, regardless of the shape. It will stop at any *on* pixel, as well as at the edges of the screen. The x and y parameters determine where it will start and also set a begin-point for future DRAWTO commands. Atari users, remember to draw a line at the left of whatever you are going to fill, as this FILL needs a border to stop at. However, it's much more flexible than the XIO command.

● **!TEXT x,y, "string" (!T.)** The TEXT command allows text to be located starting at any column and row on the GRAPHICS 8 screen (it will execute on GRAPHICS 7 screens, but produces strange multicolored characters). The "string" can be characters enclosed in quotes, a string variable, or combinations of the two. An additional parameter can be passed before the "string"; a 0 or 1 in this position determines whether the computer will use upper/lowercase text or graphics and uppercase. The program is initially set up to use lower- and uppercase. No control characters will be printed, but the RVS ON and RVS OFF characters have their usual effect of putting the characters in-between in reverse video (or inverse video for Atari people). Remember that the x and y parameters must be specified for each TEXT command, although the uppercase/graphics need only be set once to be used repeatedly. The reverse video, however, turns off at the end of the string.

● **!QUIT (!Q.)** This command cuts 64 Paintbox out of the command processing loop and removes the check on error-message display. The program can be restarted with SYS 49152. Calling SYS49152 repeatedly will not, by the way, create any difficulty.

Programmer's Notes

Locations 3 and 4 hold two variables used by the interrupt that drives the text window to determine uppercase/graphics for the window and hi-res/multicolor for the graphics. To use location 3 to control the case in the window, POKE 3 with 21 for uppercase/graphics and with 23 for lowercase. (And note that *lowercase is required* for entering commands in lower/uppercase mode.) Register 4 is used by the program to determine pixel plots, LOCATE returns, and so forth, and so may be used to flip between hi-res (8) and multicolor (24). Other values generate interesting, and harmless, effects.

Memory configuration for 64 Paintbox is:

0400–07E7	Used as the text window (the bottom four lines, at least)
0800–9FFF	Unused and completely free for BASIC programs
A000–BC7F	BASIC ROM with RAM underneath
BC80–BFFF	Used for data tables and the FILL routine stacks
C000–C7FF	The 2000 bytes of actual program
C800–CBFF	Used as the color screen for all but 11 pixels in GRAPHICS 8
CC00–CFFF	Left free for use by the DOS Wedge or other utility
E000–FFFF	Operating System ROM, with the graphics screen under it

Variable storage is:

Permanent: locations 3–6, 251–254 (interrupt shadows: 3 = 53272, 4 = 53270)
Temporary: locations 27–42, 107–113, 158–159, 163–164, 167–170
Non-zero page storage: locations 670–699

Abbreviations For 64 Paintbox Commands

DRAWTO	!DR.
PLOT	!P.
POSITION	!PO.
GRAPHICS	!G.
COLOR	!C.
LOCATE	!L.
FILL	!F.
TEXT	!T.
QUIT	!Q.

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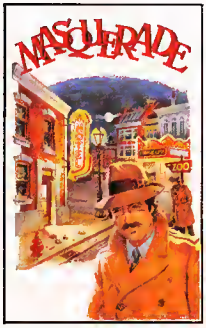

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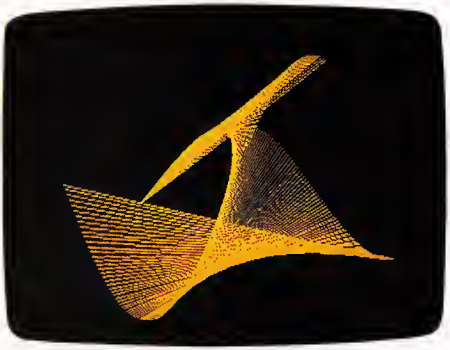
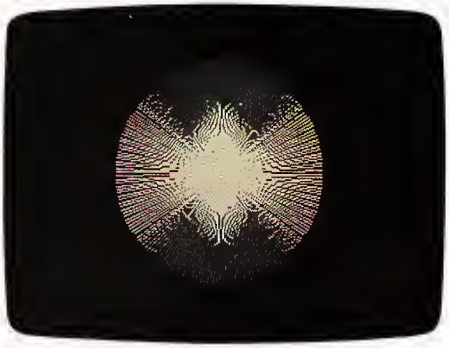


The screen graphics on this page were created with "64 Paintbox" and Program 3.

Demonstrations

Program 3 is a short program which illustrates how 64 Paintbox can be used. It draws several figures on the screen and then waits for a keypress from you to continue. To see this demonstration, make sure 64 Paintbox is in memory (if you load it manually, remember to type SYS 49152 and NEW), then load Program 3. Run it and watch the effects.



Program 1: 64 Paintbox

Refer to the MLX article in the back of this issue before typing in the following listing.

```
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49158 :141,160,188,169,000,141,037
49164 :128,188,170,189,128,188,235
49170 :024,105,064,157,129,188,173
49176 :189,160,188,105,001,157,056
49182 :161,188,232,224,024,144,235
49188 :234,169,001,160,007,153,248
49194 :199,188,153,192,188,010,204
49200 :153,207,188,136,153,192,053
49206 :188,010,136,016,238,169,043
49212 :003,160,006,153,216,188,018
49218 :010,010,136,136,016,247,109
49224 :169,254,160,007,153,224,015
49230 :188,056,042,136,016,248,252
49236 :169,252,160,007,153,231,032
49242 :188,153,239,188,153,247,234
49248 :188,056,042,056,042,136,104
49254 :136,016,239,169,066,141,101
49260 :000,003,169,197,141,001,107
49266 :003,169,134,141,008,003,060
49272 :169,192,141,009,003,169,035
49278 :008,133,004,169,055,133,116
49284 :001,096,160,001,177,122,177
49290 :201,033,240,003,076,228,151
49296 :167,165,212,208,249,032,153
49302 :115,000,165,122,133,158,075
49308 :165,123,133,159,162,255,129
49314 :160,000,165,158,133,122,132
49320 :165,159,133,123,232,032,244
49326 :115,000,041,127,221,242,152
49332 :192,240,245,201,046,240,064
49338 :026,009,128,221,242,192,236
49344 :240,019,189,242,192,048,098
49350 :003,232,208,248,200,200,009
49356 :224,053,144,212,162,011,242
49362 :076,066,197,185,040,193,199
49368 :141,233,192,185,041,193,177
49374 :141,234,192,032,115,000,168
49380 :169,054,133,001,032,046,151
49386 :194,169,055,133,001,076,094
49392 :174,167,068,082,065,087,115
49398 :164,080,076,079,212,080,169
49404 :079,083,073,084,073,079,211
49410 :206,076,079,067,065,084,067
49416 :197,083,069,084,067,079,075
49422 :076,176,067,079,076,176,152
49428 :071,082,065,080,072,073,207
49434 :067,211,070,073,076,204,215
49440 :081,085,073,212,084,069,124
49446 :088,212,138,194,046,194,142
49452 :031,194,181,196,199,195,016
49458 :150,196,081,193,242,197,085
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49494 :138,048,036,041,015,168,020
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49590 :208,169,198,141,038,003,171
49596 :169,197,141,039,003,169,138
49602 :100,141,020,003,169,197,056
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49614 :000,194,088,138,041,032,187
49620 :208,018,160,000,132,168,130
49626 :169,000,133,170,162,224,052
49632 :032,093,196,169,147,032,125
49638 :210,255,169,004,133,158,135
49644 :166,158,188,251,193,132,044
49650 :168,032,008,196,198,158,234
49656 :016,242,096,008,014,006,118
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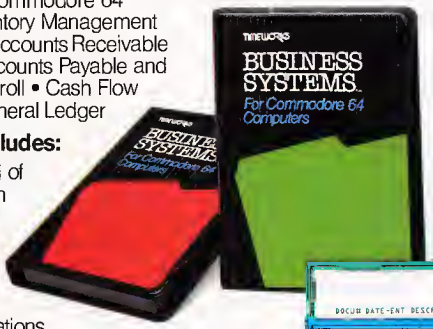

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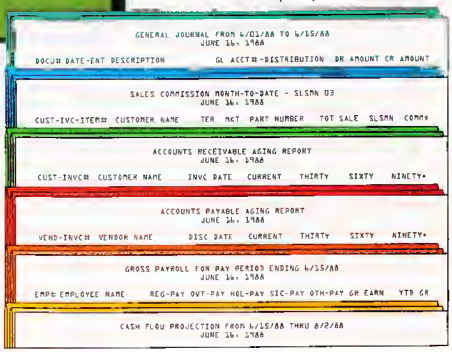

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49662 :009,000,169,000,141,026,087
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50106 :165,253,024,101,167,133,005
50112 :253,076,057,195,076,061,142
50118 :197,032,042,197,208,248,098
50124 :224,005,176,244,138,072,039
50130 :032,035,197,138,041,015,156
50136 :010,010,133,168,032,035,092
50142 :197,138,041,015,074,170,089
50148 :240,003,074,005,168,133,083
50154 :168,074,168,185,118,196,119
50160 :176,004,074,074,074,074,204
50166 :041,015,164,168,192,003,061
50172 :208,006,224,007,208,002,139
50178 :169,001,133,168,104,170,235
50184 :224,003,240,036,160,240,143
50190 :165,168,032,024,197,208,040
50196 :028,224,000,240,023,202,225
50202 :208,005,032,082,196,240,021
50208 :031,224,001,208,005,032,021
50214 :045,196,240,032,202,202,187
50220 :202,157,032,208,096,202,173
50226 :048,012,202,048,019,240,107
50232 :025,202,032,045,196,202,246
50238 :240,237,160,015,165,168,023
50244 :010,010,010,010,133,168,153
50250 :169,204,133,170,162,200,088
50256 :208,011,162,216,169,220,042
50262 :133,170,165,168,141,134,229
50268 :002,132,006,160,000,132,012
50274 :195,134,196,177,195,037,008
50280 :006,005,168,145,195,200,055
50286 :208,245,232,228,170,208,121
50292 :238,096,011,207,199,113,212
50298 :040,143,146,040,153,170,046
50304 :102,068,102,068,102,238,040
50310 :102,238,100,227,110,227,114
50316 :110,093,085,093,085,215,053
50322 :136,093,136,170,032,042,243
50328 :197,138,041,003,032,024,075
50334 :197,208,005,041,001,133,231
50340 :254,096,133,254,201,000,078
50346 :208,002,169,001,010,010,058
50352 :010,141,170,002,096,032,115
50358 :031,194,032,234,198,032,135
50364 :170,198,072,169,055,133,217
50370 :001,032,115,000,032,139,001
50376 :176,032,133,177,104,168,222
50382 :169,000,032,145,179,165,128
50388 :098,041,127,133,098,160,101
50394 :004,185,097,000,145,071,208
50400 :136,016,248,096,032,042,026
50406 :197,032,012,197,152,240,036
50412 :008,192,002,176,076,224,146
50418 :064,176,072,142,167,002,097
50424 :140,168,002,032,035,197,054
50430 :032,012,197,152,208,057,144
50436 :224,200,176,053,142,169,200
50442 :002,096,032,024,197,240,089
50448 :006,138,010,170,152,042,022
50454 :168,096,133,170,165,004,246
50460 :041,016,008,165,170,040,212
50466 :096,169,055,133,001,032,008
50472 :253,174,169,055,133,001,057
50478 :032,158,173,032,247,183,103
50484 :169,054,133,001,166,020,083
50490 :164,021,096,162,246,154,133
50496 :162,014,224,128,176,027,027
50502 :134,163,072,169,055,133,028
50508 :001,174,021,003,224,197,184
50514 :240,010,169,032,044,017,082
50520 :208,240,003,032,096,193,092
```

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```
50526 :104,166,163,076,139,227,201
50532 :173,025,208,141,025,208,112
50538 :169,027,141,017,208,169,069
50544 :199,141,000,221,169,023,097
50550 :141,024,208,169,008,141,041
50556 :022,208,162,000,173,018,195
50562 :208,048,022,162,218,169,189
50568 :196,141,000,221,169,059,154
50574 :141,017,208,169,040,141,090
50580 :024,208,169,008,141,022,208
50586 :208,142,018,208,173,013,148
50592 :220,041,001,240,003,076,229
50598 :049,234,056,032,240,255,008
50604 :224,021,176,006,162,021,014
50610 :024,032,240,255,165,003,129
50616 :141,117,197,165,004,141,181
50622 :151,197,104,168,104,170,060
50628 :104,064,072,041,127,201,037
50634 :032,144,004,104,076,202,252
50640 :241,104,032,202,241,008,012
50646 :133,170,134,158,132,159,076
50652 :056,032,240,255,224,021,024
50658 :176,006,162,021,024,032,135
50664 :240,255,166,158,164,159,094
50670 :165,170,040,096,032,031,004
50676 :194,032,234,198,169,000,047
50682 :141,174,002,169,000,141,109
50688 :176,002,141,175,002,165,149
50694 :252,208,004,165,251,240,102
50700 :033,165,251,056,237,177,163
50706 :002,133,251,165,252,233,030
50712 :000,133,252,032,170,198,041
50718 :240,229,165,251,024,109,024
50724 :177,002,133,251,165,252,248
50730 :105,000,133,252,230,253,247
50736 :032,170,198,208,011,173,072
50742 :176,002,208,011,032,212,183
50748 :198,169,001,044,169,000,129
50754 :141,176,002,198,253,198,010
50760 :253,032,170,198,208,011,176
50766 :173,175,002,208,011,032,167
50772 :212,198,169,001,044,169,109
50778 :000,141,175,002,230,253,123
50784 :032,061,194,165,251,024,055
50790 :109,177,002,133,251,165,171
50796 :252,105,000,133,252,165,247
50802 :197,201,063,240,048,165,004
50808 :252,240,006,165,251,201,211
50814 :064,176,005,032,170,198,003
50820 :240,168,172,174,002,240,104
50826 :028,136,185,000,189,133,041
50832 :253,185,000,190,133,252,133
50838 :185,000,191,133,251,140,026
50844 :174,002,165,253,201,200,127
50850 :176,226,076,253,197,076,142
50856 :034,194,032,066,194,134,054
50862 :170,189,224,188,073,255,249
50868 :162,053,120,134,001,049,187
50874 :195,230,001,088,072,165,169
50880 :170,041,007,170,104,236,152
50886 :178,002,176,007,074,232,099
50892 :236,178,002,144,249,201,190
50898 :000,096,172,174,002,165,051
50904 :251,153,000,191,165,252,204
50910 :153,000,190,165,253,153,112
50916 :000,189,238,174,002,096,159
50922 :162,001,160,007,032,024,108
50928 :197,240,002,232,136,142,165
50934 :177,002,140,178,002,096,073
50940 :032,042,197,208,015,224,202
50946 :040,176,011,134,163,032,046
50952 :035,197,208,004,224,025,189
50958 :144,005,162,014,076,066,225
50964 :197,169,000,133,196,165,112
50970 :163,010,010,010,038,196,197
50976 :024,125,128,188,133,195,057
50982 :165,196,125,160,188,133,237
50988 :196,169,055,133,001,032,118
50994 :115,000,032,158,173,165,181
51000 :013,048,025,032,247,183,092
51006 :165,020,041,001,008,173,214
51012 :160,199,040,208,003,041,207
51018 :247,044,009,008,141,160,171
51024 :199,076,049,199,165,098,098
51030 :208,015,032,133,177,160,043
51036 :002,177,071,153,097,000,080
51042 :136,016,248,048,011,165,210
51048 :023,133,022,165,023,056,014
51054 :233,003,133,023,165,097,252
51060 :240,089,169,000,141,180,167
51066 :002,173,160,199,041,251,180
51072 :141,160,199,169,000,133,162
51078 :159,172,180,002,177,098,154
51084 :032,208,199,144,052,010,017
51090 :038,159,010,038,159,010,048
51096 :038,159,133,158,165,159,196
51102 :024,105,216,133,159,160,187
51108 :007,162,055,169,051,120,216
51114 :133,001,177,158,145,195,211
51120 :136,016,249,134,001,088,032
51126 :165,195,024,105,008,133,044
51132 :195,144,006,230,196,165,100
51138 :196,240,010,238,180,002,036
51144 :173,180,002,197,097,208,033
51150 :180,096,170,201,018,208,055
51156 :008,173,160,199,009,004,253
51162 :141,160,199,201,146,208,249
51168 :008,173,160,199,041,251,032
51174 :141,160,199,138,041,127,012
51180 :201,032,144,010,138,201,194
51186 :128,041,191,144,002,233,213
51192 :064,056,096,013,013,013,247
```

Refer to "COMPUTE!'s Guide To Typing In Programs" before typing in the following listings.

Program 2: 64 Loader

```
100 IFA=1THENSYS49152:NEW          :rem 38
110 PRINT"{CLR}{3 DOWN}":PRINTTAB(14)"
    {RVS}64 PAINTBOX"              :rem 162
130 PRINT"{DOWN} !GRAPHICS SELECTS GRAPHI
    C MODE (0,7,8)"                :rem 102
140 PRINT" !COLOR SELECTS COLOR REGISTER"
                                   :rem 253
150 PRINT" !SETCOLOR SETS THE REGISTER'S
    {SPACE}COLOR"                  :rem 113
160 PRINT" !POSITION PLACES THE GRAPHICS
    {SPACE}CURSOR"                 :rem 198
170 PRINT" !PLOT PLOTS THE POINT SET BY C
    OLOR"                          :rem 204
180 PRINT" !DRAWTO DRAWS TO THE SPECIFIED
     POINT"                        :rem 119
190 PRINT" !LOCATE PUTS THE POINT IN THE
    {SPACE}VARIABLE"               :rem 185
195 PRINT" !TEXT PUTS TEXT ON THE SCREEN"
                                   :rem 165
200 PRINT" !QUIT DISABLES PAINTBOX COMMAN
    DS"                            :rem 197
210 PRINT"{DOWN}ALL COMMANDS CAN BE ABBRE
    VIATED WITH":PRINT" A PERIOD (.)"
                                   :rem 220
220 PRINT"{DOWN}LOADING ML INTO LOCATIONS
     49152-51200 .."               :rem 121
230 A=1:LOAD"PAINTBOX",8,1          :rem 8
```

Program 3: 64 Paintbox Demonstrations

```
100 :                                   :rem 203
110 REM DEMOS FOR 64 PAINTBOX           :rem 164
130 :                                   :rem 206
140 GOSUB700                            :rem 172
150 DATA "{WHT}SIMPLE FIGURE NUMBER 1"
                                        :rem 127
160 DATA "HIT ANY KEY AFTER THIS DESIGN,
    {SPACE}AND ALL"                     :rem 231
170 DATA "FOLLOWING DESIGNS, ARE COMPLETE
    "                                   :rem 17
180 DATA "TO GO ON TO THE NEXT ONE.",
                                        :rem 204
190 FORI=0TO270STEP5:!PL.I,100+SIN(I/50)*
    100:!DR.319-I,100+COS(I/25)*50:NEXT
                                        :rem 68
200 GETA$:IFA$=""THEN200                :rem 71
210 GOSUB700                            :rem 170
220 DATA "THIS FIGURE IS DRAWN IN HIRES T
    HEN"                                :rem 69
230 DATA "REDISPLAYED IN MULTICOLOR FOR A
    N"                                  :rem 64
240 DATA "INTERESTING EFFECT",          :rem 25
250 FORI=0TO309STEP2:!PL.I,100+SIN(I/50)*
    100:!DR.I+10,100+SIN(I/50)*50:NEXT
                                        :rem 6
260 GOSUB640:GOSUB700                   :rem 3
270 DATA "HIRES/MULTICOLOR FIGURE NUMBER
    {SPACE}2",                          :rem 148
280 FORI=0TO309STEP2:!PL.I,100+COS(I/50)*
    100:!DR.I+10,100+SIN(I/50)*50:NEXT
                                        :rem 4
290 GOSUB640:GOSUB700                   :rem 6
300 DATA "SIMPLE FIGURE NUMBER 2",
                                        :rem 164
310 FORI=0TO319STEP2:!PL.I,100+SIN(I/50)*
    100:!DR.319-I,100+COS(I/50)*50:NEXT
                                        :rem 61
330 GETA$:IFA$=""THEN330                :rem 79
340 GOSUB700                            :rem 174
350 DATA "SIMPLE FIGURE NUMBER 3",
                                        :rem 170
390 FORI=0TO310STEP5:!PL.I,100+SIN(I/50)*
    100:!DR.319-I,100+SIN(I/50)*50:NEXT
                                        :rem 68
420 GETA$:IFA$=""THEN420                :rem 79
430 GOSUB 700                           :rem 174
440 DATA "THE NEXT IMAGE IS A CIRCLE",
                                        :rem 52
460 FORI=0TO2*↑-↑/100STEP↑/100:!PL.160,10
    0:!DR.160+COS(I)*100,100-SIN(I)*80
                                        :rem 176
470 NEXT:C=0:I=2                        :rem 182
480 !SE.1,C,I:I=I+1:IFI=16THENI=2:C=C+1:I
    FC=16THENC=0                        :rem 130
490 GETA$:IFA$=""THEN480                :rem 92
500 DATA "THIS IS A MULTICOLOR IMAGE"
                                        :rem 117
510 DATA "CREATED WITH LINE AND FILL ROUT
    INES",                              :rem 239
520 !GR.7+16:!CO.1:N=32:FORI=0TO2*↑STEP↑/
    N                                   :rem 75
530 !CO.1:!PL.80,50:!DR.80+COS(I)*40,50-S
    IN(I)*32:NEXT                       :rem 209
540 N=16:!CO.2:FORI=0TO2*↑STEP↑/N:X=80+CO
    S(I)*50:Y=50-SIN(I)*40              :rem 73
550 !PL.X,Y:!DR.80+COS(I+↑/N)*50,50-SIN(I
    +↑/N)*40:NEXT                       :rem 185
560 !CO.3:!PL.0,0:!DR.159,0:!DR.159,99:!D
    R.0,99:!DR.0,0                      :rem 110
590 GETA$:IFA$=""THEN590                :rem 95
620 !GR.7:!GR.0:END                     :rem 26
630 :                                   :rem 211
640 GETA$:IFA$=""THEN640                :rem 87
650 !GR.7+32+16:!SE.0,2,8:!SE.1,5,8:!SE.2
    ,0,14                               :rem 70
660 GETA$:IFA$=""THEN660                :rem 91
670 GOTO750                             :rem 114
690 :                                   :rem 217
700 PRINT"{CLR}{DOWN}":!GR.0:K=0        :rem 80
710 READN$:IFN$=""THEN730               :rem 171
720 PRINTTAB(20-LEN(N$)/2)N$"{DOWN}":K=K+
    1:GOTO710                           :rem 27
730 PRINTTAB(17)"£6 @3":PRINTTAB(17)"
    {RVS} WAIT {UP}"                    :rem 70
740 FORI=1TO350*K:GETA$:IFA$=""THENNEXT
                                        :rem 133
750 !GR.8+16:!SE.2,0,0:!SE.1,RND(1)*15,10
    :!CO.1:RETURN                       :rem 192
```

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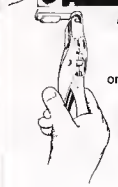

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VIC Music Maker

Frank Colosimo

Here is a program that can help you more easily create sound effects or generate songs. The BASIC program generates its own DATA statements as notes are played, allows realtime playing of notes, and lets you adjust the tempo.

"VIC Music Maker" is an easy to use, multifunctional music program for VIC-20s of all memory sizes. Immediately after running, a menu is displayed which gives you a choice of four options. You can:

1. Develop sound effects or play simple music using the keyboard.
2. Play back music or sound effects previously added to the program.
3. Generate DATA statements "recording" the music as you play it on the keys.
4. Produce a tape file composed of DATA statements and a sound-generating subroutine which can easily be added to other programs.

After typing the program, check for errors, save a copy on tape or disk, and run it. A menu will direct you to select one of the four choices by pressing keys 1 through 4.

Playing And Recording

Press 1 to play music on the keyboard. You can try the tune at the end of this article or experiment to get sound effects. Pressing the S key returns you to the main menu.

Press 3 to "record" what you play in DATA statements. The program will ask you for a starting DATA line number. By default, the number 1000 is printed on the screen, and simply pressing RETURN produces DATA lines starting with this number. Avoid numbers that are used in the program lines.

While you're playing notes, DATA statements will be created on the screen. You can play up to 95 notes before the screen fills and the program ends. Pressing the S key (or reaching the maximum number of notes) causes the program to print one final DATA statement with a value of 99. This is the signal used by the playback loop to indicate end of data.

With your DATA lines on the screen, you can move the cursor up to each DATA line number and press RETURN. This will enter the lines into your program. If you hit a bad note or two, you can do a little editing on the numbers before entering them. Of course, if you do not want to keep a recording of your playing, you can simply rerun the program.

Automatic Music

Selecting option 2 from the menu plays back the music you recorded in the DATA statements. VIC Music Maker plays back notes until it encounters the number 99, signaling that the tune is done. The RESTORE command in line 220 allows only a single tune to be played. By removing it, you can have a number of tunes stored in DATA statements, and they'll be played one by one as you press key 2.

The fourth menu option lets you save a copy of your efforts on tape or disk and later merge it with another program. VIC Music Maker asks you to prepare a cassette or disk and input a filename. Then it requests the number of the last line to be saved. All lines between 800 and this line will be stored. Lines 800–940 contain the playback subroutine, so you'll have both the musical DATA statements and the routine to merge with your other program.

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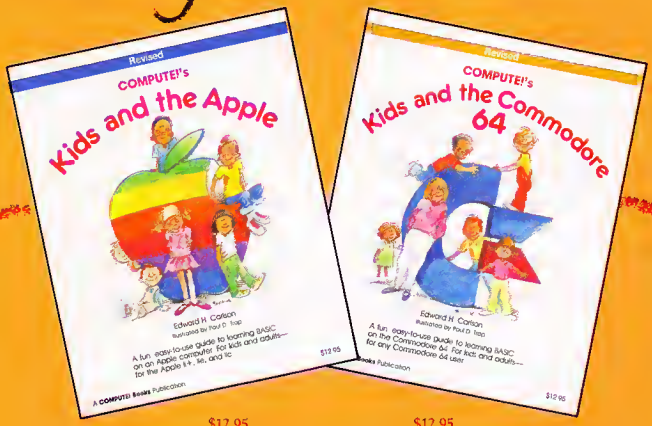

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Note: VIC Music Maker, as listed, is designed for saving the music data on tape. To modify the program for disk, substitute the following lines for the lines in the listing:

```
610 PRINT"{CLR}POSITION DISK IN DRIVE":IN
    PUT"ENTER FILE NAME{7 RIGHT}";A$
                                :rem 228
660 PRINT"{DOWN}{GRN}OPEN1,8,1,";CHR$(34)
    ;A$;CHR$(34);":CMD1:LIST800-";A
                                :rem 233
680 PRINT"{BLU}{4 DOWN}WHEN DISK STOPS, M
    OVE CRSR TO{2 SPACES}{GRN}PRINT#{BLU}
     AND{3 SPACES}PRESS {RVS}RETURN{OFF}"
                                :rem 217
```

Merging Music With Other Programs

The tape or disk file saved by VIC Music Maker is a *data file* rather than a *program file*. It's not stored the same way as BASIC programs. To merge it with another program, or load it by itself, use the following procedure for tape:

1. Place the cassette containing the file into the tape drive.

2. Enter the direct command: **POKE19,1:OPEN 1**

3. Press RETURN, and when requested, start the tape.

4. When the tape stops moving (after it finds the file), clear the screen, press the cursor-down key *exactly three times* to put you on line four, and enter the following line:

PRINT"{HOME}":POKE198,1:POKE631,13:POKE153,1

5. Press RETURN. When the tape comes to a final stop, enter **CLOSE 1** and press RETURN.

The sound routine and DATA lines are now added to your own program already in memory. A few cautions are in order, however. First, the merge technique will wipe out any lines in your program if they have the same numbers as the incoming lines. Second, if DATA statements are used in your other program, you will probably have to remove the RESTORE from line 220 and check for proper order of the READ and DATA statements.

To merge data files from disk, first type in Program 2, "VIC Disk Merger." Save a copy before running it, because the BASIC loader portion automatically erases itself from memory when you type RUN. When you have a copy saved, type RUN and follow this procedure:

1. Load the program to which you want to add the music DATA statements.

2. Enter **SYS 828,"*filename*"** (where *filename* is the name of the music data file).

3. You'll see the data lines being entered on the screen. Ignore any error messages you might see.

That's it. The sound routine and DATA statements are now part of your program already in memory. Observe the same precautions noted for tape merges above.

How It Works

VIC Music Maker was written in response to trial-and-error efforts at generating songs and sound effects. I was fascinated with the idea of the computer writing its own program lines.

Lines 20 through 40 initialize A(0)–A(9), which are the frequency values that are POKEd into the sound generator to produce musical tones. The next few lines generate the menu and send the program to the routine that is selected.

Lines 140 through 170 let you play notes on the keyboard. As written, the program uses a single voice (S2=36876) and ten notes. The other voices, including the noise generator, could be substituted here.

Lines 200 through 240 generate what "plays" the DATA statements. There are two numbers for each note in the DATA lines. The first one is the element of array A that will be POKEd into the sound generator. The second is a duration figure. The value of T also is used as a factor in determining the duration of each note and provides an easy way to change the tempo of song playback. Simply adjust its value higher or lower.

The next section, from line 310 to 520, creates DATA statements on the screen as you play the notes. The duration of each note is obtained with the VIC's built-in timing variable, TI. The complex string expression in line 420 trims off all extra blanks that the VIC tries to print so the maximum number of notes can be squeezed into the DATA lines.

Lines 600–700 produce a tape file (or disk file, if you've substituted the lines above).

VIC Music Maker was written using fairly straightforward BASIC programming principles. This makes it a good program to study for those just starting to learn programming.

If you don't want to type in the program, send a cassette, a self-addressed, stamped envelope, and $3 to:

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Sample Tune

Play the notes below using menu selection 1 or 3:

"A Bicycle Built For Two"

```
0 8 7 6
4 5 6 4 6 3
7 0 8 6
4 5 6 7 8 7
8 9 8 7 0 8 7 6
7 8 6 4 6 4 3
3 6 8 7 3 6 8 7
8 9 0 8 6 7 3 6
```

After selecting option 3, you can play the VIC keyboard like an organ as the computer converts the notes into numbers. The encoded music can then be saved for later playback or added to your own programs.

Refer to "COMPUTE!'s Guide To Typing In Progroms" before entering these listings.

Program 1: VIC Music Maker

```
10 REM MUSIC MAKER                    :rem 54
15 PRINT"{CLR}"                       :rem 202
20 S2=36876:POKES2+2,15               :rem 15
30 N$="215,159,163,175,183,191,195,201,20
   7,209"                             :rem 237
40 FORM=0TO9:A(M)=VAL(MID$(N$,4*M+1,3)):N
   EXT                                :rem 55
50 PRINT"{CLR}PRESS{DOWN}":PRINT"{RVS}1
   {OFF} TO PLAY MANUALLY{DOWN}"      :rem 148
60 PRINT"{RVS}2{OFF} TO HAVE VIC PLAY
   {DOWN}"                            :rem 253
70 PRINT"{RVS}3{OFF} TO CREATE DATA{DOWN}
   "                                  :rem 145
80 PRINT"{RVS}4{OFF} TO SAVE MUSIC FILE
   {DOWN}"                            :rem 149
85 PRINT"{RVS}5{OFF} TO STOP{DOWN}"
                                      :rem 17
90 GETS:ONSGOTO120,200,310,600,110
                                      :rem 144
100 GOTO90                            :rem 51
110 END                               :rem 105
120 PRINT"{CLR}"SPC(89)"PLAY NOTES ON
   {RVS}1{OFF} - {RVS}8{OFF}"         :rem 21
130 PRINTSPC(5)"{DOWN}*{RVS} S{OFF} TO ST
   OP *"                              :rem 22
140 GETA$:IFA$=""THEN140              :rem 77
150 IFA$="S"THENPOKES2,0:GOTO50       :rem 117
160 POKES2,0:FORA=1TO20:NEXT          :rem 245
170 N=VAL(A$):POKES2,A(N):GOTO140:rem 190
200 REM PLAY SECTION                  :rem 193
210 T=16:REM TEMPO VAL                :rem 17
220 READN:IFN=99THENPRINT"YOUR CHOICE":RE
   STORE:GOTO90                       :rem 24B
230 POKES2,A(N):READD:FORM=1TO(10*D*T):NE
   XT                                 :rem 133
240 POKES2,0:FORA=1TO20:NEXT:GOTO220
                                      :rem 251
300 REM COMPOSE SECT                  :rem 188
310 INPUT"DATA LINE# 1000{6 LEFT}";L
                                      :rem 195
320 PRINT"{UP}ENTER NOTES {RVS}S{OFF} TO
   {SPACE}STOP":X=L                   :rem 249
330 GETA$:IFA$=""THEN330              :rem 79
340 PRINT"{GRN}";L;"DATA";:C=0        :rem 203
350 C=C+1:IFC=20THENPRINT"{LEFT} ":L=L+1
                                      :rem 106
360 IFL=X+5THENGOTO500                :rem 102
370 IFC=20THEN340                     :rem 209
380 IFA$="S"THENPRINT"{LEFT} ":GOTO500
                                      :rem 8
390 POKES2,0:FORZ=1TO20:NEXT:TI$="000000"
   :POKES2,A(VAL(A$))                 :rem 244
400 PRINTA$+",";                      :rem 92
410 GETA$:IFA$=""THEN410              :rem 77
415 IFMID$(TI$,5,1)<>"0"THENPRINT"9,";:GO
   TO350                              :rem 144
420 PRINTRIGHT$(STR$(INT(TI/12)+1),1)+","
   ;:GOTO350                          :rem 137
500 REM END/COMPOSE                   :rem 149
510 POKES2,0                          :rem 166
520 PRINTL+1;"DATA 99{UP}{BLU}":END
                                      :rem 152
600 REM SAVE MUSIC FILE               :rem 74
610 PRINT"{CLR}POSITION TAPE IN DRIVE":IN
   PUT"ENTER FILE NAME{7 RIGHT}";A$
                                      :rem 227
620 PRINT"ENTER LAST DATA LINE{2 SPACES}T
   O BE SAVED":INPUTA                 :rem 5
640 PRINT"{CLR}{DOWN}{BLU}MOVE CRSR TO
   {GRN}OPEN{BLU} AND{2 SPACES}PRESS
   {RVS}RETURN{OFF}"                  :rem 149
660 PRINT"{DOWN}{GRN}OPEN1,1,1,";CHR$(34)
   ;A$;CHR$(34);":CMD1:LIST800-";A
                                      :rem 226
680 PRINT"{BLU}{4 DOWN}WHEN TAPE STOPS, M
   OVE CRSR TO{2 SPACES}{GRN}PRINT#{BLU}
    AND{3 SPACES}PRESS {RVS}RETURN{OFF}"
                                      :rem 216
700 PRINT"{DOWN}{GRN}PRINT#1:CLOSE1{BLU}"
   :END                               :rem 137
800 REM PLAYBACK SUB.                 :rem 219
805 S2=36876:POKES2+2,15:T=20         :rem 119
810 N$="215,159,163,175,183,191,195,201,2
   07,209"                            :rem 35
820 FORM=0TO9:A(M)=VAL(MID$(N$,4*M+1,3)):
   NEXT                               :rem 109
900 READN:IFN=99THENPOKES2,0:RESTORE:RETU
   RN                                 :rem 128
920 POKES2,A(N):READD:FORM=1TOD*T*10:NEXT
                                      :rem 58
940 POKES2,0:FORM=1TO10:NEXT:GOTO900
                                      :rem 18
999 REM THREE BLIND MICE              :rem 142
1000 DATA8,3,7,2,6,5,8,3,7,1,7,1,6,4,0,2,
     9,3,8,5,0,3,9,2,9,1,8,4,3,1,6,2,6,1,
     5,1,4,1                          :rem 248
1001 DATA5,1,6,2,3,1,3,2,3,1,6,2,6,1,5,1,
     4,1,5,1,6,2,3,1,3,2,3,1,6,2,6,1,5,1,
     4,1,5,1                          :rem 200
1002 DATA6,2,3,1,3,2,9,1,8,4,7,4,6,9
                                      :rem 250
1003 DATA 99                          :rem 80
```

Program 2: VIC Disk Merger

By Charles Bronnon, Program Editor

```
100 PRINTCHR$(14)"{CLR}{RVS}VIC DATA MERG
   ER LOADER"                         :rem 179
110 PRINT"{2 DOWN}NOW READING DATA..."
                                      :rem 23
```

```
120 FORI=828TO939:READA:POKEI,A:CK=CK+A:N
    EXT                                  :rem 24
130 IF CK<>13998 THEN PRINT"{UP}ERROR IN
    {SPACE}DATA LINES.":END              :rem 63
140 PRINT "{UP}VIC DATA MERGER NOW":PRINT
    "IN MEMORY."                         :rem 82
150 PRINT"{DOWN}TO MERGE AN ASCII":PRINT"
    SEQUENTIAL FILE, ENTER"              :rem 211
160 PRINT"SYS 828,";CHR$(34);CHR$(34);CHR
    $(20)"{RVS}FILENAME{OFF}";CHR$(34)
                                         :rem 41
170 PRINT"{DOWN}{RVS}FILENAME{OFF} IS THE
     NAME":PRINT"OF THE ASCII FILE."
                                         :rem 181
180 NEW                                  :rem 131
828 DATA 032,253,206,032,158,205   :rem 41
834 DATA 032,130,215,166,034,164   :rem 37
840 DATA 035,032,189,255,169,032   :rem 50
846 DATA 162,008,160,008,032,186   :rem 44
852 DATA 255,032,192,255,169,099   :rem 64
858 DATA 141,036,003,169,003,141   :rem 38
864 DATA 037,003,096,008,138,072   :rem 49
870 DATA 152,072,169,008,032,180   :rem 44
876 DATA 255,169,104,032,150,255   :rem 51
882 DATA 032,165,255,141,172,003   :rem 40
888 DATA 032,171,255,165,144,240   :rem 51
894 DATA 026,169,032,032,195,255   :rem 56
900 DATA 032,138,255,169,008,032   :rem 41
906 DATA 177,255,169,232,032,147   :rem 56
912 DATA 255,032,174,255,169,013   :rem 47
918 DATA 141,172,003,173,172,003   :rem 35
924 DATA 201,013,240,003,032,210   :rem 13
930 DATA 255,104,168,104,170,040   :rem 35
936 DATA 173,172,003,096           :rem 167 ©
```


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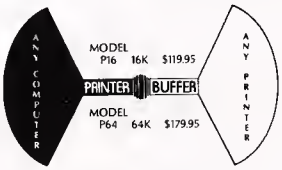

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Enchanter

Marc Berman

Requirements: Apple Macintosh; Apple II-family computer with at least 32K RAM and a disk drive; Commodore 64 with a disk drive; or an Atari with at least 48K RAM and a disk drive. The version reviewed was for the Macintosh; other versions are identical.

The adventure game wizards at Infocom have just unleashed a new challenge—*Enchanter*, which the package blurb claims "is in the *Zork* tradition." That's quite a tradition to live up to, because as practically all adventure-game addicts know, Infocom's best-selling *Zork* trilogy set new standards for adventure game sophistication. Yet *Enchanter* upholds those high standards. And it even includes some of the characters from *Zork*.

Enchanter is strictly a text adventure—no pictures. Again, this is an Infocom tradition. Infocom maintains that personal computer graphics are not yet advanced enough to match the picture in your mind's eye. If you enjoy reading novels as much as watching TV, you'll probably agree.

Enchanter should be especially welcomed by Macintosh users. Until now, they haven't had many games to choose from, except for *Transylvania*, *Millionaire*, and the simple puzzle game that comes with the Mac.

A Well-Woven Tale

This is a remarkably well-planned game which encourages you to make logical or instinctive decisions. There's nothing strikingly original about it, but you'll appreciate its high level of challenge and meticulously maintained continuity.

The premise is that Krill, an evil sorcerer, has control of the land. The Circle of Enchanters sends you, a novice enchanter, to stop him. You might ask, "Why don't they go themselves?" Well, they claim Krill might recognize one of them—a likely story. Anyhow, along the way, you must find scrolls which reveal the magic you will need to seek out and vanquish Krill. Some of the scrolls are hidden along the roads around Krill's castle and some are in the rambling castle itself. Other spells are revealed by friendly animals, and at least one spell requires another spell to unlock it.

Keeping a map as you find your way through this complex game is absolutely essential. The bigger the paper, the better. Your starting point is at the western extreme, so you might want to start your map at the left edge of the paper.

You begin at a fork in a road. Explore both forks before you approach the castle. There are supplies you will need along each trail. Be practical. One of the strengths of this game is its tether to reality. The sun comes up and goes down at regular intervals. You get hungry, thirsty, and sleepy in cycles. And characters you meet respond in predictable ways. For example, an adventurer you meet in Krill's castle is suspicious of you, even if you offer him lunch. With so much evil lurking, it makes sense to be suspicious.

Likewise, a dog may show interest in you only when you have something it wants. On the other hand, you may learn something valuable with an off-the-wall command. For instance, by commanding, "Take all," you will find out what is portable in a room. But be careful—don't do something you wouldn't do in real life, such as extinguishing your lantern to learn the spell you need to light it again.

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But the spells are the key to *Enchanter*. At the outset you're given four: Gnusto, Frontz, Blorb, and Nitfol. Gnusto writes magic in your spell book. Frontz illuminates. Blorb protects your belongings. And Nitfol lets you talk to the animals. These four spells won't get you very far. Some of the first spells you'll find when you explore are a spell to open locked objects, a spell to repair damaged items, and a one-time-only spell that dispels evil magic.

Among the things that go bump in the night are a turtle, a dog, an adventurer, and some mean hairy guys who want to plunge a knife into you. There are other friendly and threatening creatures, but these are some that can move from room to room. You can summon certain creatures, like Belboz, your mentor, but he won't always be pleased to see you. Fortunately, there aren't so many moving creatures that you can't always find safe havens to sleep or otherwise regroup.

You can become stalemated, but entering "Wait" may change the situation. You can also return to rooms you already visited and find them altered. Or you can go to sleep—are those dreams you're having, or are they clues? Even an inexperienced player can discover or create new possibilities, though they may lead to his demise.

Exceptional Documentation

No expense was spared on the documentation, which is complete and flashy. For instance, the map-making advice is prepared by The Guild of Cartographers and the advice on entering commands comes from The Guild of Scriveners. You'll have to review the instructions carefully at least once before you'll get the hang of playing. It takes a while to remember all the idiosyncrasies of *Enchanter*, such as rules for talking to animals. Animals answer only "Who" and "Where" questions. For instance, you might say, "Frog, where is a scroll?" But don't ask "Frog, where are scrolls?" because *Enchanter* doesn't know the word *are*.

Most adventure gamers enjoy a good joke now and then, or at least a worthy attempt. Some of the old Adventure International games and other Infocom games are pretty witty. *Enchanter* has intelligent gameplay, but some of the humor lacks, well, subtlety. One character's name is Lord Dimwit Flathead. If you enter too many off-the-wall commands, the game will comment that you must be under a silliness spell.

The narrative won't win any literary awards, either. The package copy was obviously very carefully written, but the text in the program is sometimes vague. For instance: "A more incongruous place than this would be difficult to believe"; or "a door surpassing anything you could have imagined." I don't want to nitpick, but considering the overall excellence of this game, the writing ought to be better.

At least you don't have to worry about the kids getting funny ideas from *Enchanter*. There's very little violence in this game, for all its drama. As an enchanter, you have no use for knives or other weapons. Outwitting your opponents is more effective than killing them.

An Advanced Adventure

Enchanter is a huge program. The Macintosh version of the

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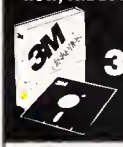

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game takes up 122K on the disk. By comparison, the *MacWrite* word processor takes up only 55K. The system folder on the Macintosh *Enchanter* disk accounts for another 139K, leaving roughly 140K for storage. Saving a game in progress requires 13K, so some quick division tells you there is disk space for ten games.

Crashing the system is possible with the Macintosh, I discovered, when I accidentally hit the option key. The message SYSTEM ERROR appeared and the only recourse was to restart the disk, losing the game.

Enchanter is an excellent game for adventure freaks. However, you wouldn't want to use it to introduce your Aunt Fanny to computers—it's pretty advanced, even for seasoned adventurers.

With its large vocabulary, you won't tire too quickly of *Enchanter*. Even when you stop playing, you'll find yourself thinking about possible solutions for hours afterward. The challenge will preoccupy you for a long time.

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Andrew Keith

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Typically, the language retails for between $100 and $200. The Commodore 64, however, has the virtue of being inexpensive as home computers go; it is also remarkably versatile. Given this, it is not surprising that the Commodore 64 *Logo* package is both affordable and powerful.

Designed for Commodore by Terrapin, the 64 version of Logo makes good use of the hi-res graphics, sprites, color and sound capabilities for which the 64 is known. It also includes a thorough manual/tutorial and a utilities/demo disk. The price: about $50–$80, although it can be picked up on sale for as low as $35 at some retail outlets.

Logo includes both the turtle graphics system and a sophisticated language that is stimulating and challenging for adults as well as kids. Logo is a user-friendly cousin to languages like LISP, which are used in research on artificial intelligence. Because of this, it operates using a system called "list-processing," which organizes its programs as lists of procedures. Each procedure is itself a list of procedures; so a Logo program follows a "tree" structure, all the way down to the smallest roots, which are the built-in commands that come with the language. If this description seems a bit abstract, consider this standard example, one of the first Logo graphics programs most people learn to write:

```
TO SQUARE        ; Name of the procedure
 FORWARD 50      ; Moves the screen turtle
                   forward 50 "turtle steps"
 RIGHT 90        ; Turtle turns 90 degrees
                   right—
 FORWARD 50      ; Across the top...
 RIGHT 90        ; Another turn—
 FORWARD 50      ; Down the other side...
 RIGHT 90        ; Turn again—
 FORWARD 50      ; Bottom of the square
 RIGHT 90        ; Turn turtle back to
                   original heading
END
```

Taking Shortcuts

Does all that seem repetitive? Too much typing? Logo lets you abbreviate and take shortcuts, doing the whole thing more elegantly:

```
TO SQUARE
 REPEAT 4 [FD 50 RT 90]
END
```

Commands like FORWARD, BACK, RIGHT, and LEFT are called Logo "primitives." The user puts them together into procedures such as SQUARE. The interesting thing is that, for all practical purposes, Logo treats primitives like FORWARD and procedures like SQUARE as though they were identical. This lets the user "teach" the computer new commands. These commands can then be used over and over again in different programs.

Seymour Papert, the man who headed the original Logo project, had worked with the late Jean Piaget, the renowned Swiss psychologist who studied how people—particularly children—learn to teach themselves. Logo reflects Piaget's philosophy, and that is why Papert and many others consider it an ideal educational tool, if used properly. In a Logo environment, children develop an instinct for geometry and mathematical relationships by "teaching" the turtle to walk around the screen, drawing figures of startling complexity.

Thinking About Thinking

Having defined SQUARE, we can now use it as part of another procedure called HOUSE, which can in turn be part of a larger procedure called CITY. That is all, in essence, a Logo program is: a list of procedures. By breaking down the problem of drawing a city into the procedures of drawing a house, a square, a window, or a roof, children learn to structure their thinking. Bugs in the program are solved by "playing turtle"—that is, physically retracing the turtle's directions. In the process, says Papert, they become epistemologists: They learn to think about thinking.

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The manual that comes with 64 *Logo* also reflects this philosophy of learning. It introduces the user to the language by allowing him or her to choose the features that are of initial interest, and starting there.

The tutorial chapters are nondirective, taking you through the steps needed to become acquainted with techniques for building programs. Having grounded you in the basics, it then simply suggests experiments, rather than telling you what to do. Three Logo "mascots" help you pace yourself: An elephant means "this is important: remember this"; a rabbit means "here is a valuable shortcut or a programming trick"; a snail means " go slowly in this section." The tutorial is excellent in most respects, but young children will find it rough going—the print is small, and it is really targeted for adult users who want thorough documentation on the language.

Graphics & Assembler

The utilities/demo disk contains several useful programs and procedures. Some are used in conjunction with the manual to demonstrate how to manipulate sprites (64 *Logo* has a total of seven) or play music. Others are graphics demos or simple games that show how list processing works. Utilities include sprite files with ready-made shapes of animals, vehicles, and assorted figures; a sprite editor for redefining your own shapes; and even a machine language assembler written in Logo for creating your own user-callable machine language routines.

The demo disk is a nice idea, but some of the demo programs are a bit disappointing; they are more fragments of programs than actual programs. Undoubtedly, that is all that was intended—program examples that the user can elaborate on—but you can't help responding to some of the demos with "That's it?" One exception is a Logo version of the famous game "Animal" in which the user thinks of an animal and the computer asks a series of questions to "guess" the name of the animal, in the process creating a tree-like classification structure which can then be viewed using the "Animal Inspector" program. This classic demonstration of simplified artificial intelligence makes particularly good use of Logo's list-processing abilities, as well as showing the user how the language stores its information.

A Sound Solution

Logo's system for handling the sound capabilities of the 64 is fairly simple, and the demo disk provides ready-made procedures like PLAY to make it even simpler. Basically, you decide what values your notes should have and what duration they should be; Logo does the rest. The manual doesn't point out how to control all three voices or how to set the volume. A serious programmer could write routines to handle these features, using the .DEPOSIT command (Logo's equivalent of the BASIC command POKE). The routines provided on the disk are satisfactory for most types of music and sound effects needed.

In addition to its turtle graphics and extras like sprites and sound, Logo is a natural for handling words and sentences. It contains all sorts of primitives for manipulating phrases. For example, typing in:

```
PRINT SENTENCE [JOHN LIKES]
 ITEM 3[ MARY SUE[TO SKI]]
```

Will print out:

```
JOHN LIKES TO SKI
```

The primitive SENTENCE will put together two elements that follow it into a single sentence, and ITEM 3 will pick out the third item in a list. Note that the bracketed phrase "to ski" is treated as one element of the list. Logo also has primitives for determining if a particular piece of input matches one or more elements in a given list. These text-manipulation features are the true core of Logo, and make it well-suited for educational uses.

Friendly Bugs

Commodore *Logo*'s error messages are friendly. If you attempt to use a procedure and haven't defined it, *Logo* will tell you that it doesn't know a procedure by that name. It also tells you exactly where the error was found. In the event of a major error that hangs up the system, *Logo* stops itself in many cases and cheerfully informs you: CONGRATULATIONS! YOU FOUND A BUG! It then gives you the option of continuing where you left off or erasing the faulty procedure and starting completely from scratch. However, the one time this happened to me the restart option didn't work quite right, resulting in input problems. I ended up turning off the computer and rebooting the language disk.

All in all, this is a solid version of Logo for a reasonable price. It contains features lacking in some of the other versions of Logo—sprites, sound, the ability to save drawings from the screen, and touch-sensitive turtles (any of the sprites can be used as turtles) that can sense contact with the background or other turtles. On top of this, it costs less than any other implementation of Logo currently on the market. For both first-time users, exploring their first programming language, and seasoned hackers—children and adults alike—Commodore 64 *Logo* is an excellent package.

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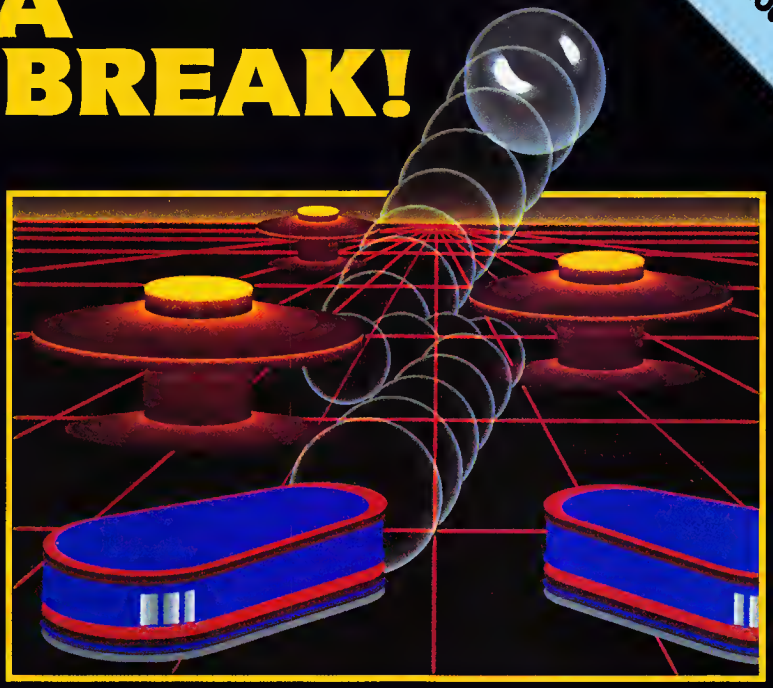

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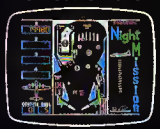

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Microsoft Flight Simulator For PC & PCjr

David Florance, Programming Assistant

Requirements: IBM PC with at least 64K RAM, one disk drive, and color/graphics adapter (optional Microsoft Mouse requires 128K RAM); or PCjr with at least 128K RAM and one disk drive. Joystick optional.

Commercial flight simulators were developed for one very good reason: Airplanes cost a great deal of money. When a student learning to fly makes a mistake, it's better for the mistake to happen in a flight simulator safe on the ground than to lose an entire aircraft (not to mention the trainee pilot).

Several software companies have recently adapted flight simulators to personal computers. You can't expect to use these programs to qualify for a pilot's license, but they're both fun and educational.

Microsoft Flight Simulator, by Bruce A. Artwick of SubLogic, is one of the best. For most of the last year it's been a top-selling program for the IBM PC and compatibles. The latest version sports two major improvements: It runs on both the PC and PCjr, and it generates a color display on direct-drive RGB monitors. Earlier versions depended upon artifacting (false high-resolution colors) to create color displays. This was fine if you plugged your PC into a composite color monitor or TV set. But everything appeared in black and white on RGB monitors because they're capable of resolving adjacent hi-res pixels without the artifacting effect. The new version of the program generates true colors on both types of displays.

Before you try *Microsoft Flight Simulator*, however, be forewarned—if you don't know much about flying, this program may overwhelm you. It's not a simple simulation. It's a challenging program even for experienced pilots. Your first step should be to read the 149-page manual, packed with diagrams, maps, runway layouts for dozens of airports, an appendix describing your plane's performance specs, an airport directory, a glossary of aviation terms, and an index. The manual explains how to fly the aircraft with either the keyboard or a joystick, plus a great many more details.

This view from the pilot's window shows a landing approach to Los Angeles International Airport.

Changing The Weather

Before you take off, read the section that explains how an aircraft operates. Once you know a bit about flying, you'll be better prepared to enjoy (and understand) *Microsoft Flight Simulator*. Even if you've done some flying, you'll benefit by reading the manual.

Next, if you're using a PCjr, you should become familiar with the keyboard overlay. If you have a PC, you'll have to work without an overlay, so carefully study the section on aircraft controls. It explains the various instruments you'll be working with. These instruments

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An alternate simulation, World War I Ace, puts you in the cockpit of a 1917 warplane. Notice the more primitive instrumentation.

should be constantly monitored during flight because they indicate your airspeed, attitude, altitude, heading, and throttle at a glance.

With any program requiring sharp hand-eye coordination, practice makes perfect. But it's especially critical with *Microsoft Flight Simulator*. When using the keyboard controls, keep the manual in a strategic location for easy reference. As you improve your flying skills, you'll learn how to use navigational aids such as the VOR, the ADF, the NAV 1, NAV 2, and COM radios. You can use the 3-D display window to look around you from nine different perspectives. Finally, there is the radar view, which is indispensable when taxiing on the runways.

With the program's Editor feature, you can redefine current flight parameters. The User Mode Library gives you ten preset modes plus options to save and load player-defined modes. You can use the Editor to set cloud layers, wind factors, seasons, and even the time of day. Say, for instance, you want to work on landing skills. You would call the Editor, set the flight parameters for a landing approach, save it in the Library, and reenter the flight mode.

Until you gain a working knowledge of the instruments, you'll have trouble making successful flights. You won't fly far if you haven't practiced banks and yaws, or use of the elevators. You'll sometimes crash, but don't be discouraged when it happens.

Four Regions And A War

Microsoft Flight Simulator lets you choose to fly from Chicago, New York, Los Angeles, or Seattle. Numerous airports are available for landings, and—as in real life—not all are identically equipped. Larger airports have more sophisticated equipment. There are hours of exploration within each region.

Flying from one region to another is possible, too, but it may take four or five hours. Slewing, or exponential travel, is an alternative to realtime flying. It allows you to rapidly travel great distances in little time.

In addition to the four regions available for civilian flight, there's also a fifth simulation—World War I Ace, a game which places you in Europe in 1917.

Controls Are Sensitive

Microsoft Flight Simulator is interesting, challenging, graphically superb, diverse, rewarding, and just plain fun. And the documentation is great. In terms of realism, it sets the standards.

There are two slight drawbacks. The instruments in *Microsoft Flight Simulator* are more delicate than on real aircraft. There are legitimate arguments that this is the way a flight simulator should respond; it trains you to develop even more skill than flying a real plane would require. But others would prefer to see more realistic controls which respond exactly like the real thing.

The other weakness is an obvious one that applies to all personal computer flight simulators: the absence of rudder pedals and similar controls. Controlling the aircraft with keys or a joystick may befuddle pilots who are used to real controls.

Still, these shortcomings are easily outweighed by the sheer delight this program brings.

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DataPlus-PC

Darryl G. Linkow

Requirements: IBM PC or XT with at least 128K RAM, DOS 2.0/2.1, and either two double-sided floppy disk drives or a single double-sided drive and a hard disk.

DataPlus-PC converts your computer into an electronic filing system and report generator

which can perform the sophisticated data base functions found in programs that are considerably more expensive. Yet unlike some of these higher-priced programs, *DataPlus-PC* is extremely easy to use, even for novices. It is completely menu-driven and prompts you at every option.

Beginners can start entering data immediately by using the predefined record fields (name, address, etc.). Of course, you can also design your own custom forms. With the Report Generator included in *DataPlus-PC*, you can perform extensive mathematical functions. *DataPlus-PC* also contains a built-in Mailing Label and List Generator (MLG) that can print up to eight labels across. It's a fast, easy way to print labels or other lists. Another powerful feature is the memo window. It lets you enter a paragraph of text so you can link additional information and comments to individual records that are on file.

DataPlus-PC also is capable of reading files created with *Lotus 1-2-3, Multiplan, VisiCalc, TIM,* and other popular forecasting and data base programs. This capability saves you the costly and time-consuming task of retyping existing files to assemble new data bases with *DataPlus-PC*. In addition, *DataPlus-PC* can create files which can be merged with the text files produced by most popular word processing programs (including *WordPlus-PC*, a companion program from Professional Software).

Single-Key Commands

DataPlus-PC comes on a double-sided floppy disk with an instruction manual in an attractive (IBM-style) three-ring binder and slipcover. The manual itself is well-organized and written for both the novice and advanced user. There's an excellent 170-page tutorial section and a reference section of about the same length. Index tabs make it fast and easy to find helpful information. In the back is a complete index, plus an appendix with information on DOS, error messages, printer troubleshooting, a glossary of computer terms, and a section on saving crashed data files.

The program disk contains sample data files to illustrate everything covered in the tutorial. Since *DataPlus-PC* is completely menu-driven, you should be able to use the program even if you skip the tutorial. Most commands are entered by selecting a single number or letter from the main menu. This menu offers such functions as the report generator, mailing label generator, word processor file merge, the utilities menu, and the global function menu. With a single keypress you can select such options as enter records, update records, delete records, quick search, super scan, memo window, change data files, sort records, and display unformatted records.

The utilities menu lets you create new files, print field titles, add new data fields, change field titles, view report formats, erase report formats, duplicate report formats, rename data files, erase data files, create modified files, back up data files to another disk, convert ASCII files to *DataPlus-PC* files, and view disk directories.

The global menu contains many functions usually found only in word processors: global search and replace, global record delete, global mathematical update, global deletion or insertion of fields, merge two fields or two *DataPlus-PC* files, swap two fields, duplicate data from one field to another, convert data format, and convert data file to all uppercase letters. Again, you can select any of these functions by pressing a single key from the proper menu screen.

Fast Searching

DataPlus-PC's super scan function gives you the ability to quickly locate and display necessary information from any record. In seconds, using floppy disks, I retrieved records just by specifying a string of letters or numbers. Once the record appears on the screen, you can use the super scan menu to edit the record, delete the record, print a hard copy, or perform several other functions.

The printing features in *DataPlus-PC* are extremely flexible, too. Using the report generator, you can specify any number of fields to be printed in unique reports. You can design report formats and save them on disk. In addition, *DataPlus-PC* always asks if you want data and reports sent to the screen or the printer. You don't have to make a hard copy if you simply want to read a report on the screen.

Overall, *DataPlus-PC* offers professional versatility and a great number of advanced features. But perhaps the best feature is its price—relatively low compared to some competitors with similar capabilities.

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David D. Thornburg, Associate Editor

Of Cats, Kids And Computers

I read an interesting article about cats. It was about an experiment in which newborn kittens were raised in special environments. One group of kittens was raised from birth in a room containing only vertical stripes on its walls, and the second group was raised in a room with only horizontal stripes on its walls.

As these kittens matured, they were released into the normal world of chairs, tables, and people, to see how they would react. The researchers in this study made some interesting observations. The cats that were raised among only vertical stripes fared well in the world of chairs and tables, without ever bumping into the legs by accident. But these cats never once jumped onto a chair or table top. As for the cats raised in the other room, their behavior was quite different. While they would frequently jump on table tops and chairs, they seemed to be forever bumping into furniture legs—almost as if they didn't see them.

Were these effects reversible? As I recall, it was discovered that the effects of these special rooms would wear off only if the kittens were removed from the rooms after a few weeks. If they were kept in these environments for a longer period, the sensory environment of their youth would forever influence their view of the world.

Kids, of course, are not cats, and yet parents share an almost instinctive need to provide their children with all the stimulation they can handle. From crib toys to peekaboo, our babies have their waking hours filled with the wide range of stimuli that might forever shape their own views of the world.

But, just as some of our parentally provided stimulation is intentional, some of it is not. A child who is raised from birth in front of a television set is likely to have a different world view than one who was engaged in more active pursuits. We have all heard of the toddler whose first song was "You Deserve a Break Today."

Childhood Discovery Tools

Fortunately, our babies don't rely on us as their sole source of stimulation for long. What parent hasn't noticed that the baby has been "too quiet," only to find that the little pumpkin is busily exploring the rich texture of strained apricots as they are pressed into the white living room rug a mere two hours before guests arrive for a formal dinner?

While most parents are not likely to view this incident with detached amusement and recognition of the strong desire of our children to make discoveries on their own, we do acknowledge the importance of discovery to our children and provide them with discovery tools of our choosing—blocks, dolls, trucks, and perhaps computers.

The notion that a computer can be a discovery tool for the very young is not particularly new. What is new is the growing realization that if computers are to be used by the very young, they must be used in ways that are completely different from the ways they are used by older children and adults.

I am often presented with opportunities to review commercial educational software for the preschooler. While this software has a certain appeal for the adults who purchase it, much of it is totally inappropriate for its targeted user. The reason for this is easy to detect: Our commercial marketplace has presented us with a problem. In order for a customer to find appropriate software in the store, a buyer has to be sufficiently impressed to purchase it. Amazingly few buyers for retail chains have Ph.D.'s in early childhood education, and the criteria that a buyer may use in selecting titles for inventory are likely to be different from those that are of importance to the cognitive development of a three-year-old child. As a consequence, I have seen otherwise charming alphabet-learning programs that paint words from right to left across the screen, thus causing the child's eyes to track in the wrong direction for reading. I have seen prereading software that includes (in small type) messages such as PRESS RETURN WHEN DONE.

In fact, good software is hard to write, and good software for preschoolers is *very* hard to write. Consequently, there is very little of it.

Designing Software For Tots

To see the nature of the problem, consider three aspects of a child's use of the computer. In order to interact with the computer effectively, three

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things need to be at the child's level: the input skills, the subject matter and style, and the information displayed on the screen. Some otherwise wonderful software has fallen short because of a failure in one of these areas.

Many of the shortcomings in early childhood software can be overcome by careful design of the program in the first place. While too many experts can ruin an otherwise good product, it is important that software be examined by someone on the staff who has worked extensively with children in the target age-range, and who knows their skills and limitations. It is also important that the software be tested (and modified and tested again) with a group of children to see what problems they uncover. In fact, most of the problems I have seen could have been trapped and corrected at the storyboard stage before a single line of program was written.

Of course, such testing is expensive, and it causes product development cycles to be much longer than they would be otherwise. When these factors are considered in the light that a good children's package may be harder to program than a new spreadsheet, it is a miracle that there are any good programs available at all.

In fact, there is much that any programmer can do to make sure that programs for young children are appropriate. On the content side, give careful consideration to the dominant learning mode of the child. If the audience consists of children who are engaged in making their own discoveries by physical experimentation, the interactiveness of the program should reflect this learning mode. If the program is to be used by early readers, be certain that the screen is free of clutter and the words are formed from characters that are easy to read. Just because a child can read a ¼-inch-high letter in a book does not mean that you should use letters of this size when working with a computer display screen. You will want to use letters that are much larger and that are created with a very easy-to-read set of characters.

Keeping It Simple

Animation has its place, but words should not move across the screen while they are being read. Reading is a hard enough task as it is, and making the words move only makes it worse. You can test this on yourself by having words move across the screen in a language you barely understand. You will most likely find that the words are a lot easier to read when they are standing still.

If your software is to be used by a child who has no reading skills, and this software is to be used by an unattended child for purposes other than *developing* these skills, the screen should contain no words at all—ever.

Color and sound can be entertaining, but must be used carefully. If the object is to create a passive viewing experience as a reward, this may be fine. If these features are used as a bridge between other activities in the program, they may distract the child enough to cause the thought train to be broken.

While content and display present their own special problems, the real challenge comes from input. Devices like the joystick and KoalaPad represent two alternatives to the normal keyboard, but they may be inappropriate for some applications, especially when letters and numbers are to be entered.

As for the typewriter keyboard, we have two choices: We can either change the order of our alphabet for all time into QWERTYUIOP[]ASDFGHJKL;ZXCVBNM,.? or we can take advantage of special keyboards such as the Muppet Learning Keys from Koala Technologies. Muppet Learning Keys is a keyboard designed for children from the age of three upward. Its principal features are an alphabetic arrangement of keys, an uncluttered layout with one character per keytop, and functional clustering of keyboard characters. All the numbers are clustered into one grouping, colors are clustered into a paint box, and the alphabet is clustered in a writing tablet.

Since we teach our children the alphabet in alphabetical order, it makes sense for them to be able to use a computer keyboard that has the keys in this order as well.

Graduating To QWERTY

Of course, there is the question of when a child should make the move up to the normal keyboard layout.

To me, the essence of keyboard comfort is achieved by starting children off with something that they expect—alphabetic keys. This makes using the computer more transparent to the user, and gives the child a closer connection to the software, instead of requiring continued focus on the mechanics of the computer's operation.

Once a child has reached an age where he or she is ready to learn to type, the child's first exposure to the normal keyboard should be through a typing tutor program.

At what age should the transition take place? It depends on the child of course, but you should look at the skills needed to master the keyboard (and mastery does not include typing with two fingers). Is it a skill for three-year-olds? I think not. In fact, it might be appropriate for some preteens, but not all of them.

In fact, it isn't even appropriate for all adults! ©

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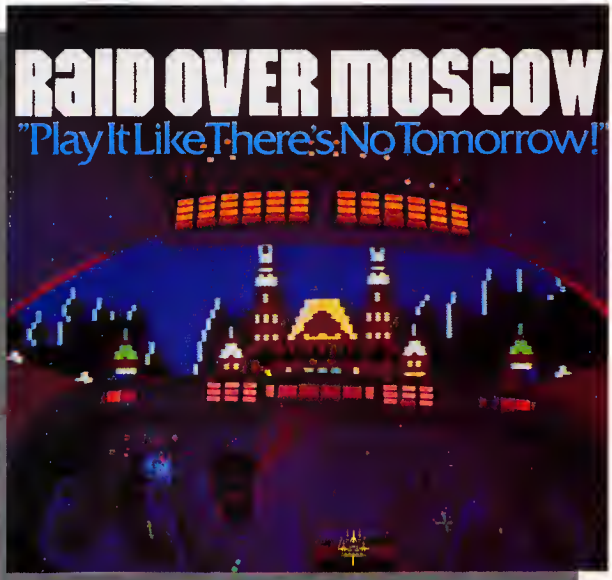

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TELECOMPUTING TODAY

Arlan R. Levitan

COMPUTE! *welcomes a new monthly column this issue: Arlan R. Levitan's "Telecomputing Today." It's a general column for everyone who has an interest in telecommunications with personal computers—no matter which computer you own.*

Levitan has wide experience in this field: He was introduced to computing in 1966 when his high school was among the first in the nation to participate in a pilot computer-instruction project. Today he's a staff analyst in technical support for the data processing division of a major telephone company. His work has appeared in such magazines as Softside *and* Creative Computing.

He has edited a major user group newsletter and is the author of The Consumer's Guide to Atari Computers. *He is an assistant sysop (system operator) for the CompuServe Information Service and subscribes to The Source and Delphi as well. He also was the system designer of AMIS, a major bulletin board program for Atari systems. Levitan owns and uses Atari, IBM, and Apple personal computers and has experience on all types of computers.*

1984, eight years into the microcomputer revolution. It's hard to ignore recent trends which indicate that the explosive growth rate enjoyed by this industry is leveling off. As you read this, retailers of mass-market computers are yearning nostalgically for the frantic buying of the past two years.

This is not to say that the home computer market is ready to lie down and die. Millions of computer enthusiasts are active with their systems, and the market is, by ordinary standards, still quite vigorous.

The revolution has yielded to evolution. By current reckoning, almost half of the families who purchased computers during the boom years of 1982 and 1983 are letting their systems gather dust in dark closets or relegating them to use as expensive paperweights.

Large numbers of people hung up their computing shoes after just a few months of experimentation with their new toys. They discovered to their genuine dismay that word processors do not write letters by themselves, spreadsheets do not make entries in checkbooks, and that maintaining data bases of recipes isn't such a hot idea after all.

It certainly wasn't the public's fault. Everyone from a well-meaning but starry-eyed press to the refrigerator salesmen who found themselves selling disk drives instead of ice-cube makers firmly believed that personal computers could do almost anything in the hands of almost anyone. No one wanted to think about the possibility that the classical business applications of microcomputers would not translate well into the home.

Is Computing Antisocial?

The slowdown began late in 1983. Several companies tried to boost their holiday season sales with "big fear" campaigns, losing points with educators and sociologists by implying that refusing to buy your children a home computer would doom them to failure in the competitive atmosphere of higher academics.

The campaign for 1984 has been "personal productivity." Home computer owners want to use their machines without learning how to program and without spending hours trying to figure out how a canned application works. Yet the most popular type of home software is still games, the best of which offer intuitive rules and interaction with other human players as well as the computer.

Interaction is an important point. To some extent, the classical applications of microcomputer technology all tend to isolate the user in a one-on-one relationship—with the computer, a machine. But a computer's reactions to user input are usually well-defined and limited.

Things don't have to be this way. The more personal interaction that can be brought into "personal" computing, the more engaging and rewarding it can be.

Reach Out And Touch

There is a segment of computing that brings people into contact with one another, rather than encouraging isolation. According to a recent Public Broadcasting System market survey, that segment boasts a user satisfaction rate of more than 90

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percent (compared to an average of about 50 percent for home computer owners as a whole).

That segment is comprised of home computer owners who use their systems to hook up with other computer systems and their users via telephone lines. The general application is referred to as telecommunications or *telecomputing*, and unlike the rest of the home computer market, it's still growing at an accelerated clip.

Do you find this hard to believe? Consider that the most popular features on the commercial information services such as CompuServe and The Source are those which center on people-to-people contacts.

On CompuServe it's the CB simulation, a freewheeling computerized version of Citizens Band radio. Except with this CB, you're not limited to a range of ten miles or so. Your buddies on the channel may be as far-flung as Fairbanks, Miami, and Bangor. The intellectual content, the wit, of these electronic conversations may never rival Plato's discourses, but it is fascinating to watch and participate in.

On The Source it's POST, a national bulletin board that can put you in touch with the lady in Butte, Montana, who's willing to sell the used letter-quality printer you've always wanted, and the stamp collector in Fargo who's willing to pay top dollar for those Millard Fillmore commemoratives you've been trying to unload locally for over a year.

On Delphi it's the ORACLE, where networked bands of self-styled experts on any subject under the sun are more than willing to voice their opinion on any question posed to them.

You Are What You Say

Why are people attracted to personal keyboard conversations with folks they've never met before? Because this mode of communication is the great equalizer. No one knows or really cares whether you're a yuppie, preppie, hacker, punk, or blue-suiter. You're judged by your words and general attitude.

Telecomputing offers a commonality of experience that can be shared by almost every computer owner. The telecomputing experience crosses all boundaries of computer brands, operating systems, and programming languages.

Common telecomputing applications offer convincing evidence of the power of the medium. How many stock market buffs spend countless hours typing issue histories into spreadsheets and other stock analysis programs? The same information can be transferred directly from an on-line information service to a formatted file on a personal computer in a matter of minutes.

How many students wait and wait for an hour of time at a college computer terminal? A personal computer in a dorm room can access the same system. How many times have you flown within the past year? The Official Airlines Guide (OAG), accessible via computer, can pinpoint the lowest fare available in a matter of seconds.

A vast number of free public bulletin boards accessible by computer offer information ranging from Aerospace to Zoology. Free user-written programs for almost any type of computer may be transferred with ease from one remote system to another.

Undeveloped Potential

Telecomputing is not without its failures. For all the publicity about electronic editions of popular national newspapers, it turned out that not too many people cared to pay five to ten dollars for the information found in 25 cents' worth of newsprint. Electronic banking's development has been tediously slow, and the U.S. Postal Service is about to give up on its electronic mail service, ECOM (they never could get the hang of handling lowercase letters).

Still, there's plenty available now, and the cost of a ticket to telecomputing is extremely low—especially for those who already own a computer.

Modems, the devices that make it possible for computers to link up to other computers over ordinary phone lines, are available for under a hundred dollars and are extremely reliable. Most can be used with almost any computer, so they can be shared by more than one system if you're a two-computer family.

Terminal programs—which turn a computer into a telecomputing device—are commonly available in the form of public-domain software at little or no cost. Terminal programs also are published from time to time in computer magazines such as COMPUTE! and COMPUTE!'s GAZETTE.

So start saving your money for a modem, and if you've been neglecting it, dust off that computer. In the months that follow, this column will take you on a tour of a huge communications network that many people don't even know exists. Before we're done, tenderfoots will become well-seasoned hands, and old telecomputing prospectors will learn of some rich new lodes of information to mine.

BCNU
Arlan R. Levitan

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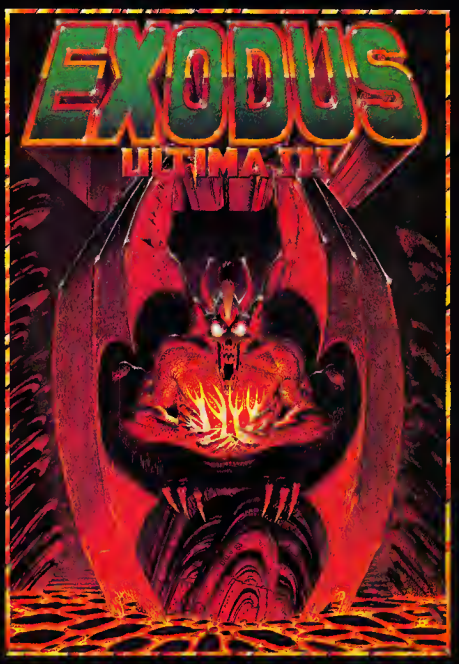

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MACHINE LANGUAGE

Jim Butterfield, Associate Editor

A Simple Sort

I recently received a request from Marshall Stewart in Louisiana for a numeric array sort. Such a sort isn't too useful for real data, but can illustrate a number of machine language coding techniques.

It should be noted that a sort, in order to be practical, should be able to find its way through multifield records and should handle strings, floating point, and fixed point numbers. The program presented here, "Tiny Sort," is written for the Commodore 64 and sorts a single floating point array into ascending order. This might be useful for certain types of statistical analysis, but is otherwise of limited practical use.

The sorting method (or *algorithm*) is called an "insertion sort." In other words, each number is inserted into the collection of sorted numbers obtained so far. As an example; suppose we have so far sorted the five numbers: 3, 8, 22, 35, and 84. Now the next number comes along; it has a value of 18. The insertion sort will "move up" the values 22, 35, and 84, pop the 18 into the blank space to get the sequence of six: 3, 8, 18, 22, 35, and 84. This algorithm is easy to follow, but like most simple sorting procedures it takes a long time to sort large arrays. Most simple sort algorithms are called "N squared"; this means that if you have an array twice as big as before, it will take four times as much time to do the job. With large collections of data, the programmer must seek out more sophisticated algorithms.

So Tiny Sort is limited in application, and it uses a decent but not superfast algorithm. It is useful for study purposes, however. We do a number of interesting jobs, such as digging into the workings of an array and comparing floating point numbers.

Tracking The Program

When Tiny Sort is called, it assumes that only one array is in the machine—or at least it looks only at the first array. It assumes that the array is one-dimensional, that the type is floating point, and that the zero element is part of the data to be sorted. We could choose to check all this, but let's forge ahead.

How do we find the array? Well, there's a pointer which indicates the start of the first array, and that's the one we want. It's called the Start-of-Arrays pointer (ARYTAB), and in the Commodore 64 it's found at addresses $2F and $30. (Consult your memory maps to find similar pointers in other 6502 machines.) By looking at this pointer, we can tell where to find the first array.

The array comes in two parts: information about the array, and the array data itself. Most of the information we'll pass by: the array name, its size in bytes, and the number of dimensions. We'll assume it's the right array and that it's singly dimensioned. One piece of information we will extract: the number of elements in the array. That will tell us how many items we have to sort. If there are 15 elements, we'll need to do 14 inserts. The first element is already "sorted." The number of elements is held in two bytes, which are to be found five locations from the start of the array. So we dig out the array size minus one and place it into our storage location we call SIZE, at hex address 033D and 033E:

```
        LDY   #5          ;get array size
        LDA   (SOA),Y     ;from pointer
        TAX               ;size hi byte
        INY               ;try for lo byte
        LDA   (SOA),Y     ;here it is
        TAY               ;check zero
        BNE   DECK        ;minus one
        DEX
DECK    DEY
        STY   SIZE        ;store size
        STX   SIZE+1
```

Now let's go for the array data. For a single dimension array, we must skip ahead 7 locations to get past the overhead information. The start of the data will be logged in START, and we'll also place it into pointer NEXT. START will stay where it is, but NEXT will move along as we add

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data to our sorted list.

```
        CLC             ;go for start
        LDA   SDA       ;of array
        ADC   #7        ;plus 7
        STA   START     ;gives start
        STA   NEXT      ;of numbers
        LDA   SDA+1
        ADC   #0
        STA   START+1
        STA   NEXT+1
```

Now we accept a value into the sorted list, and move pointer NEW along five locations. Each floating value occupies five locations.

```
* SORT NEW ITEM INTO EXISTING ARRAY
BIGLP   CLC             ;on to next
        LDA   NEXT      ;array item
        ADC   #5        ;five bytes up
        STA   NEXT
        LDA   NEXT+1
        ADC   #0
        STA   NEXT+1
```

All five bytes of the new item of data, which pointer NEW has selected, are transferred to a work area WORK. That makes comparisons simpler, but performs another task. As we search the list, we'll move the existing items up to make room. The new value's old location will be written over as we do this move.

```
        LDY   #4        ;move item to
MVLP    LDA   (NEXT),Y  ;work area
        STA   WORK,Y    ;for testing
        DEY
        BPL   MVLP
```

Now the stage is set. We'll call subroutine SCAN to find the proper insertion point, move the existing values over, and put the new value in place.

```
        JSR   SCAN      ;insert it
```

Most of the work has been done. We may count the number of insertions—by counting down SIZE—and if there are more numbers, loop back to BIGLP.

```
        LDY   SIZE      ;now count down
        BNE   INK
        DEC   SIZE+1    ;hi and low
INK     DEC   SIZE
        BNE   BIGLP     ;more? go back
        LDA   SIZE+1
        BNE   BIGLP
        RTS
```

Subroutine SCAN's task is to move down through the data until the correct spot is found to insert the new item. We use pointer CHECK to do the scan; first, we must set it up.

```
*MOVE EVERYTHING UP AND INSERT ITEM
SCAN    LDA   NEXT      ;start at top
        STA   CHECK
        LDA   NEXT+1
        STA   CHECK+1
```

Now we move the pointer CHECK down to look at the next item. We do this, of course, by subtracting five from pointer CHECK.

```
*DOWN TO NEXT ITEM
SLOOP   SEC
        LDA   CHECK     ;go five bytes
        SBC   #5        ;lower
        STA   CHECK
        LDA   CHECK+1
        SBC   #0
        STA   CHECK+1
```

CHECK may have gone too far. We must compare it with pointer START; if it's gone below, we must insert the new item at the bottom. We do the comparison by subtraction. Usually, before we subtract, we give an SEC command; in this case, it's not necessary since we have just completed a previous legal subtraction.

```
*TEST IF BOTTOM OF DATA
        LDA   CHECK     ;subtract
        SBC   START     ;pointer from
        LDA   CHECK+1   ;bottom pointer
        SBC   START+1
        BCC   SWRAP     ;if low, wrap up
```

Now that it has been established that CHECK is in a legitimate range, we may perform the comparison. Subroutine COMPAR will do this for us. If the new value compares the right way (low), we go to SWRAP to insert it.

```
* COMPARE NEW ITEM WITH CURRENT ENTRY
        JSR   COMPAR    ;compare it
        BCS   SWRAP     ;yup, insert it
```

If we haven't rambled away to SWRAP, it means we haven't yet found the right spot to insert the new item. We move over the item in the list that we have just checked; when we finally find the right spot, everything will be moved over neatly. To move up this five-byte item, we use the stack. When we're finished, back to SLOOP to check the next point on the list.

```
* NOT YET; MOVE ENTRY UP
        LDY   #4        ;take out entry
SPUSH   LDA   (CHECK),Y ;and push to
        PHA             ;stack
        DEY
        BPL   SPUSH
        LDY   #5        ;pull entry back
SPULL   PLA             ;and insert five
        STA   (CHECK),Y ;bytes higher
        INY
        CPY   #10
        BCC   SPULL
        BCS   SLOOP     ;now get next
```

When we get to SWRAP, we can put the item into its proper place. Pointer CHECK has gone too far; rather than back it up, we use a higher index value.

```
* FOUND THE SPOT; PUT NEW ITEM IN PLACE
SWRAP   LDY   #5
SWLOOP  LDA   WORK-5,Y
        STA   (CHECK),Y
        INY
        CPY   #10
        BNE   SWLOOP
        RTS
```

The COMPAR subroutine compares signed floating point numbers. Floating point numbers as stored in arrays consist of one byte giving the exponent and four bytes giving the mantissa. But there's more: The high bit in the mantissa is the sign of the number. Providing we check the signs first, everything works out neatly: compare the exponents, then the bytes of the mantissa. But first, the signs; if they match we can continue

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with the main comparison.

```
* COMPARE CURRENT ENTRY TO NEW ITEM IN WORK
COMPAR   LDY   #1          ;floating signs
         LDA   WORK,Y
         EOR   (CHECK),Y   ;do they match?
         BMI   SGDIF       ;no, special
```

An EOR (Exclusive OR) is an excellent way to check if the high bits match. If they are different, the EOR'd result will have a high bit on, and the N flag will be set. Thus, BMI will branch on unequal signs.

If we didn't branch, the signs are the same. We still need to note the sign, since negative numbers will sort "backward" compared to positive numbers.

```
         LDA   WORK,Y      ;yes, log
         STA   SIGN        ;.. the sign
```

Now for the comparison. Quite straightforward coding.

```
* COMPARE UNSIGNED VALUE
         LDY   #0          ;compare bytes
CLOOP    LDA   WORK,Y      ;from left
         CMP   (CHECK),Y   ;to right
         BNE   CEXIT       ;quit not equal
         INY
         CPY   #5
         BCC   CLOOP
```

At this time, the C flag (carry) will tell us how the comparison went. But if the numbers are negative, we must invert the comparison result. By switching the carry flag into the high bit of the accumulator, using EOR again, and sliding the high bit back into the carry, we can do the job neatly.

```
* INSERT SIGN DATA
CEXIT    ROR               ;carry to hi-bit
         EOR   SIGN        ;flip if negative
         ASL               ;back to carry
         RTS
```

If the signs are different, we don't need to do the main comparison. The negative value is smaller, of course.

```
* DIFFERING SIGNS - SPECIAL CHECK
SGDIF    LDA   (CHECK),Y   ;get sign
         ASL               ;switch to carry
         RTS
```

That's the whole program. Note that the subroutines are called only once. In principle, we could have written the program into a single mainstream. The subroutines tend to break up the logic into neat modules, however.

Note that the comparison subroutine COMPAR always returns the result of the comparison in the Carry flag. That's where it belongs: Carry is the natural flag for signaling less-than or greater-equal-than. We might have used the N flag instead of the C flag to signal the result; this would have saved us two bytes (two ASL instructions), but it seems less comfortable than the traditional Carry.

BASIC Demonstration

The program can be typed in as a BASIC module on the Commodore 64. Since the machine language portion will end up at address $C000 (decimal 49152), be sure you don't have any special software up there.

```
10 FORI=49152TO49344                    :rem 126
20 READ A:CK=CK+A                       :rem 190
30 POKE I,A:NEXT                        :rem 193
40 IFCK<>24165THENPRINT"TYPING ERROR IN D
   ATA STATEMENTS"                      :rem 27
49152 DATA 160,5,177,47,170,200,177
                                        :rem 198
49159 DATA 47,168,208,1,202,136,140
                                        :rem 198
49166 DATA 61,3,142,62,3,24,165  :rem 250
49173 DATA 47,105,7,141,63,3,133  :rem 43
49180 DATA 251,165,48,105,0,141,64
                                        :rem 142
49187 DATA 3,133,252,24,165,251,105
                                        :rem 194
49194 DATA 5,133,251,165,252,105,0
                                        :rem 140
49201 DATA 133,252,160,4,177,251,153
                                        :rem 237
49208 DATA 67,3,136,16,248,32,83  :rem 56
49215 DATA 192,172,61,3,208,3,206 :rem 92
49222 DATA 62,3,206,61,3,208,217  :rem 38
49229 DATA 173,62,3,208,212,96,165
                                        :rem 156
49236 DATA 251,133,253,165,252,133,254
                                        :rem 90
49243 DATA 56,165,253,233,5,133,253
                                        :rem 199
49250 DATA 165,254,233,0,133,254,165
                                        :rem 243
49257 DATA 253,237,63,3,165,254,237
                                        :rem 210
49264 DATA 64,3,144,25,32,154,192 :rem 99
49271 DATA 176,20,160,4,177,253,72
                                        :rem 150
49278 DATA 136,16,250,160,5,104,145
                                        :rem 195
49285 DATA 253,200,192,10,144,248,176
                                        :rem 44
49292 DATA 206,160,5,185,62,3,145 :rem 99
49299 DATA 253,200,192,10,208,246,96
                                         :rem 1
49306 DATA 160,1,185,67,3,81,253  :rem 49
49313 DATA 48,26,185,67,3,141,72  :rem 55
49320 DATA 3,160,0,185,67,3,209  :rem 247
49327 DATA 253,208,5,200,192,5,144
                                        :rem 144
49334 DATA 244,106,77,72,3,10,96  :rem 52
49341 DATA 177,253,10,96          :rem 172
```

Once the machine language is in place, we can demonstrate the program with a random number generator. After the first program run, the machine language program remains in place and RUN 900 allows another try.

```
899 REM RANDOM NUMBER GENERATOR  :rem 191
900 INPUT"NUMBER IF ITEMS";X     :rem 218
910 J=RND(0):X=X-1:DIMA(X)         :rem 9
920 FORJ=0TOX                    :rem 52
930 A(J)=RND(1)*50-20            :rem 57
940 NEXTJ                        :rem 38
950 FORJ=0TOX:PRINTA(J);:NEXTJ:PRINT
                                 :rem 159
960 PRINT:PRINT                  :rem 243
970 SYS12*4096                   :rem 255
980 FORJ=0TOX:PRINTA(J);:NEXT:PRINT
                                :rem 88 ©
```

Applesoft Searcher

Ilan Reuben

Here's a short but very handy (and fast) programming utility written entirely in machine language. With it, you can instantly locate key statements and phrases in your programs. It works on any Apple with at least 48K RAM and a disk drive.

Many BASIC programs are constructed and debugged by adding new sections and routines to existing sections and routines. As a result, these programs can become excessively long and complex. Debugging becomes a real mess when you have to sift through 2000 lines of BASIC to find a certain routine or statement.

"Applesoft Searcher" is a machine language utility which will scan any BASIC program for all the references to a phrase you specify, and tell you where each reference is—all in the blink of an eye. The machine language program itself is just over a page (256 bytes) in length, and resides at memory location 36864 ($9000 in hexadecimal). If you know little or nothing about machine language, don't worry; you can use Applesoft Searcher as long as you can type in a BASIC program and follow a few simple directions.

Using The Searcher

First, let's get Applesoft Searcher up and running. If you feel more comfortable with BASIC and would like to load the utility as a BASIC program, type in Program 1, the BASIC loader. It's a good idea to save it just in case. Now run it. This puts the machine language portion of the utility into memory, and it remains there even after you erase the BASIC loader. Next, save the machine language portion on disk by typing:

```
BSAVE SEARCHER, A$9000, L$109
```

If you'd rather enter Searcher into the computer directly, you can use the monitor listing (Program 2) and save it as shown above. In the future, to load Searcher from disk, type:

```
BLOAD SEARCHER
```

Once you have it in memory, you must set the & vector to the start of the program. This lets you run Searcher every time you type &. From BASIC, type:

```
POKE 1014,0: POKE 1015,144
```

or from the monitor type:

```
3F6:0 90
```

Searcher should now be ready to use. Here is a sample BASIC program to show how it works.

```
10  PRINT "THIS IS A TEST"
20  FOR A = 1 TO 10
30  PRINT A + 10
40  NEXT A
```

Suppose you want to find all the references to the variable A in the program. You would type:

```
& A
```

and the computer would respond with:

```
FOUND AT LINE 10
FOUND AT LINE 20
FOUND AT LINE 30
FOUND AT LINE 40
```

To find all the lines in which the number 10 appears, type:

```
& 10
```

Searcher will hunt through the program and report:

```
FOUND AT LINE 20
FOUND AT LINE 30
```

Notice that line 10 was not included even though there is a 10 in its line number. This is because Searcher ignores line numbers.

Selective Searching

To specify a range of lines for Searcher to look through, type # after the & along with the starting and ending line numbers and the phrase to search for:

```
$ #20,30,PRINT
```

This would search lines 20 through 30 for a PRINT statement.

One more thing about Searcher: It must be used only in direct mode, not in deferred mode (that is, you cannot call it from a BASIC program). If you try, the message ?NOT DEFERRED COMMAND ERROR will be displayed.

If you'd like to have Applesoft Searcher ready to use every time you boot your system, type in the BASIC setup routine (Program 3) and use it as a hello program when initializing disks. Just make sure that you've got the machine language for Searcher saved on that disk.

Program 1: Applesoft Searcher (BASIC Loader)

```
10  FOR X = 36864 TO 37129
20  READ Y:CK = CK + Y
30  POKE X,Y
40  NEXT X
50  IF CK < > 36799 THEN  PRINT "CHECK
      DATA STATEMENTS FOR TYPING ERRORS
    "
100 DATA 165,185,201,2,240,11,169,15,3
    2,204
110 DATA 144,32,25,237,76,60,212,32,18
    3,0
120 DATA 201,35,208,40,32,177,0,32,103
    ,221
130 DATA 32,82,231,165,80,133,8,165,81
    ,133
140 DATA 9,32,190,222,32,103,221,32,62
    ,231
150 DATA 165,80,133,10,165,81,133,11,3
    2,190
160 DATA 222,76,75,144,160,0,132,8,132
    ,9
170 DATA 136,132,10,132,11,160,255,198
    ,184,32
180 DATA 177,0,201,34,208,8,165,193,73
    ,233
190 DATA 133,193,169,34,200,153,10,145
    ,201,0
200 DATA 208,233,132,6,169,239,133,193
    ,165,8
210 DATA 133,80,165,9,133,81,32,26,214
    ,169
220 DATA 3,133,7,230,7,164,7,162,0,177

230 DATA 155,240,27,221,10,145,208,241
    ,200,232
240 DATA 228,6,208,241,169,0,32,204,14
    4,160
250 DATA 2,177,155,170,200,177,155,32,
    36,237
260 DATA 160,0,177,155,72,200,177,155,
    133,156
270 DATA 104,133,155,177,155,240,10,16
    0,3,177
280 DATA 155,197,11,240,8,144,186,169,
    141,32
290 DATA 240,253,96,136,177,155,197,10
    ,240,175
300 DATA 144,173,176,239,170,169,141,3
    2,240,253
310 DATA 189,222,144,240,6,32,240,253,
    232,208
320 DATA 245,96,198,207,213,206,196,16
    0,193,212
330 DATA 160,204,201,206,197,160,0,135
    ,191,206
340 DATA 207,212,160,196,197,196,197,2
    10,210,197
350 DATA 196,160,195,207,205,205,193,2
    06,196,160
360 DATA 197,210,210,207,210,0
```

Program 2: Applesoft Searcher (Monitor Listing)

```
9000- A5 B9 C9 02 F0 0B A9 0F
9008- 20 CC 90 20 19 ED 4C 3C
9010- D4 20 B7 00 C9 23 D0 28
9018- 20 B1 00 20 67 DD 20 52
9020- E7 A5 50 85 08 A5 51 85
9028- 09 20 BE DE 20 67 DD 20
9030- 52 E7 A5 50 85 0A A5 51
9038- 85 0B 20 BE DE 4C 4B 90
9040- A0 00 84 08 84 09 88 84
9048- 0A 84 0B A0 FF C6 B8 20
9050- B1 00 C9 22 D0 08 A5 C1
9058- 49 E9 85 C1 A9 22 C8 99
9060- 0A 91 C9 00 D0 E9 84 08
9068- A9 EF 85 C1 A5 08 85 50
9070- A5 09 85 51 20 1A D6 A9
9078- 03 85 07 E6 07 A4 07 A2
9080- 00 B1 9B F0 1B DD 0A 91
9088- D0 F1 C8 E8 E4 06 D0 F1
9090- A9 00 20 CC 90 A0 02 B1
9098- 9B AA C8 B1 9B 20 24 ED
90A0- A0 00 B1 9B 48 C8 B1 9B
90A8- 85 9C 68 85 9B B1 9B F0
90B0- 0A A0 03 B1 9B C5 0B F0
90B8- 08 90 BC A9 8D 20 F0 FD
90C0- 60 88 B1 9B C5 0A F0 AF
90C8- 90 AD B0 EF AA A9 8D 20
90D0- F0 FD BD DE 90 F0 06 20
90D8- F0 FD E8 D0 F5 60 C6 CF
90E0- D5 CE C4 A0 C1 D4 A0 CC
90E8- C9 CE C5 A0 00 87 BF CE
90F0- CF D4 A0 C4 C5 C6 C5 D2
90F8- D2 C5 C4 A0 C3 CF CD CD
9100- C1 CE C4 A0 C5 D2 D2 CF
9108- D2 00
```

Program 3: Applesoft Searcher (Hello Program)

```
10 D$ =  CHR$ (4): REM CTRL-D
20  PRINT D$"BLOAD SEARCHER"
30  POKE 1014,0: POKE 1015,144
40  REM ^ SET & VECTOR ^
50  PRINT "'SEARCHER' ENABLED"
```

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Donald B. Trivette

Christmas Shopping For An IBM

Here's a one-line BASIC program that's sure to put panic in the hearts of holiday shoppers:

```
10 M=VAL(MID$(DATE$,1,2)):D=VAL(MID$(DATE
   $,4,2)):IF M=11 THEN D=55-D:PRINT D
   ELSE D=25-D:PRINT D
```

Can you figure out what it does? While you're working on that, let's talk Christmas shopping. For those friends or relatives on your Christmas list with an IBM Personal Computer, finding just the right gift may be easier than you think.

Computer programs make great holiday gifts. Well, some computer programs make good gifts. Others don't. The selection of a word processing, financial, or spreadsheet program is very much a matter of personal choice and taste. Don't give *DisplayWrite* or *VisiCalc* to someone unless it is on his or her Christmas list. For a surprise gift, stick with less expensive, one-of-a-kind software.

Subtle Intelligence-Gathering

Before we get to some specific ideas, you should do a little research. (Especially if you don't know much about computers and someone clipped this article as a hint. Otherwise you may skip this section.)

First, find out exactly which computer the intended recipient of your gift actually owns. Is it an IBM PC, PCjr, PC-XT, or Portable PC? It will be embarrassing if you buy a PCjr cartridge program for someone who owns a PC, for instance, because the PC has no cartridge slots. Perhaps you can work this query into dinner-table conversation: "Mother's coming a week early for the holidays . . . could you move the computer out of the spare bedroom? What kind is it, anyway?" If the answer is the name of a fruit, you are consulting the wrong column; otherwise, press for more information. "She's bringing her cats . . . by the way, how much memory does it have?"

Armed with the model and amount of memory, you need another fact: "Can that thing draw color pictures?" Here you're trying to find out if the PC has a color/graphics board. (The PCjr and Portable PC include this as a standard feature.) If it doesn't have a color/graphics board, it's called a monochrome system, and certain programs won't work on it.

Finally, it's important to know if the computer has a disk drive—almost all PCs do—but you won't have to ask about that. Snoop around the machine for evidence. If you find paper envelopes about 5-1/2 × 4-1/2 inches that say *disk* or *diskette* on them, you can be sure the machine has a disk drive. (Either that, or the person is hinting heavily that he *wants* a disk drive.)

By now, you've gathered the four basic (very basic) facts you need to know to purchase a program for an IBM computer: the model of the computer, the amount of memory it has, whether it is equipped for color graphics, and if it has a disk drive. For example, let's say your relative or friend has an IBM PCjr with 128K of memory (memory always comes in K's, for *kilobytes*)—and you've found the telltale envelopes that mean a disk drive. With this information you can visit a local dealer and make your selection. Your gift still may not make the person jump for joy, but at least the computer won't choke on it.

Software Suggestions

If you're stuck for an idea, I can pass on a few hints. While the following summaries aren't full-blown reviews and don't necessarily represent endorsements by COMPUTE!, they are based on my experience with the products.

ProKey is a program that works along with other software. It allows you to redefine the keys on the keyboard to have whatever meaning you'd like. For example, instead of typing four

lines of difficult-to-remember commands to start a program, you can have *ProKey* enter those lines every time you hold down the Alt key and press the A key. *ProKey* is one of those programs you don't appreciate until you've used it—then you don't want to be without it. (*ProKey 3.0* from RoseSoft; for the PC, PCjr, PC-XT; requires 64K memory, disk drive, color or monochrome; $130.)

The *Norton Utilities* is a collection of programs that allow you to examine, modify, and manipulate disk files. Unless you are interested in the complexities of disk storage, this package will sit on the shelf collecting dust—until you do the unthinkable and accidentally erase an important file. Then the UnErase program can bring it back, saving you hours or days of work. You don't need the *Norton Utilities* until something goes wrong, then you'll be awfully glad you have them. (*Norton Utilities* by Peter Norton; for the PC, PCjr, PC-XT; requires 64K memory, disk drive, color or monochrome; $80.)

Disk Drive Analyzer is an inexpensive program that tests the disk drive hardware for alignment, speed, clamping, and read/write performance, and then reports problems and potential problems. It's a program that a computer owner might not buy for himself, but which he would surely love to have. (*Disk Drive Analyzer* by Verbatim Products; for the PC, PC-XT; requires 64K memory, disk drive, color or monochrome; $40.)

Just For Fun

The programs mentioned so far could qualify as tax deductions for someone in business, and therefore might not be ideal presents. But one does not compute for practicality alone. Computer games make wonderful gifts and certainly would not be deductible. Here are three family games for consideration.

Microsoft Flight Simulator has been at the top of software best-seller lists for a long time—and with good reason. It's a realistic program that puts you in the cockpit of a Cessna 182. Even if you fear flying, you'll enjoy this program. (*Microsoft Flight Simulator* by Microsoft; for the PC, PC-XT with 64K memory, disk drive, and color/graphics; PCjr with 128K memory and disk drive; $49.95. Be sure to get the latest version which works on all types of monitors.)

Ultima II is an adventure game. You roam around the Ultima universe seeking to find and conquer the evil Enchantress. Along the way you must fend off all manner of strange characters, including Orcs, thieves, wizards, and even sea monsters. Since the adventure can easily last weeks, *Ultima* lets you save a game in progress and pick it up later. (*Ultima II* by Sierra On-Line; for the PC, PC-XT with 64K memory, disk drive, and color/graphics; PCjr with 128K and disk drive; $60.)

Championship Boxing puts you in the ring with the boxer of your choice—Duran? Leonard? Hearns?—to slug out your aggressions. Sixty of the greatest boxers are included. If you're too tired to step into the ring, you can match any two fighters and whisper strategy from the corner. A great game for a sports fan. (*Championship Boxing* by Sierra On-Line; for the PC, PC-XT with 64K memory, disk drive, and color/graphics; PCjr with 128K and disk drive; $35.)

Hardware And Accessories

Software isn't your only choice for a computer gift. Consider hardware and accessories.

Computer users can never have too many blank disks. Disks generally cost $20 to $35 for a box of ten. There are dozens of brands, but there's not a great deal of difference. Any brand labeled DS/DD (double-sided, double-density) and "soft-sectored" will work in any of the IBM PC-family computers. A related gift is a smoked-plastic storage box that holds 50 disks (about $35).

Books always make good gifts. *The Naked Computer* by Rochester and Gantz (William Morrow & Co., $15.95) is a 335-page almanac of computer facts and trivia. *Sing a Song of Software* by Soltzberg (William Kaufmann, Inc., $9.95) is a light-hearted book of computer graphics and verse:

> *Who wrote this code so long ago?*
> *I feel as if I know her, though*
> *We've never met nor shared a word*
> *Of pleasure at this program's flow.*

(Only modesty, good taste, and a picky editor prevent me from recommending my own book: *A BASIC Primer for the IBM PC*, Scott, Foresman & Co., $18.95.)

Of course, an excellent gift is an IBM PC or PCjr. If you're planning to give a computer—and retailers say quite a few of you are—then please include at least one computer program. There's nothing worse on Christmas morning than receiving a shiny new computer without a program to run on it. That's like getting a camera without film or a GI Joe Walkie Talkie without a battery.

A word about retail prices. Almost all computer programs can be purchased at a substantial discount from mail-order firms, though you may prefer the personalized service and assistance that a local dealer can provide. With the Christmas mail crunch, you may not have time to take advantage of these lower prices, unless you ask for express shipping. The BASIC program at the beginning of this article will tell you exactly how many days you *do* have. ©

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*less coupon discount

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Now you program 80 COLUMNS on the screen at one time! Converts your Commodore 64 to 80 COLUMNS when you plug in the 80 COLUMN EXPANSION BOARD!! PLUS 4 slot expander! Can use with most existing software.

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This EXECUTIVE WORD PROCESSOR is the finest available for the COMMODORE 64 computer! The ULTIMATE FOR PROFESSIONAL Word Processing DISPLAYS 40 or 80 COLUMNS IN COLOR or Black and White! Simple to operate, powerful text editing with 250 WORD DICTIONARY, complete cursor and insert/delete key controls line and paragraph insertion, automatic deletion, centering, margin settings and output to all printers! Includes a powerful mail merge

List $99.00 **SALE $49.00** Coupon $39.00

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We pack a SPECIAL SOFTWARE OISCOUNT COUPON with every COMMOOORE 64 COMPUTER OISK ORIVE-PRINTER-MONITOR we sell! This coupon allows you to SAVE OVER $500 OFF SALE PRICES!!

(Examples)
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COMMOOORE 64

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Electronic Spread Sheet	$59.95	$49.00	$39.00
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(See over 100 coupon items in our catalog)
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The Cadillac of 8usiness Programs for Commodore 64 Computers

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makes other graphics tablet obsolete. This new TECH SCETCH LEARNING PAD allows you to draw on your T.V. or Monitor and then you can print whatever you draw on the screen on your printers. FANTASTIC!!! List $79.95 **SALE $49.00.** Coupon $39.95

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Increases VIC-20 programming power 4 times. Expands total memory to 41K (41,000 bytes). Memory block switches are on outside cover! CARDCO Includes FREE $29.95 game!!

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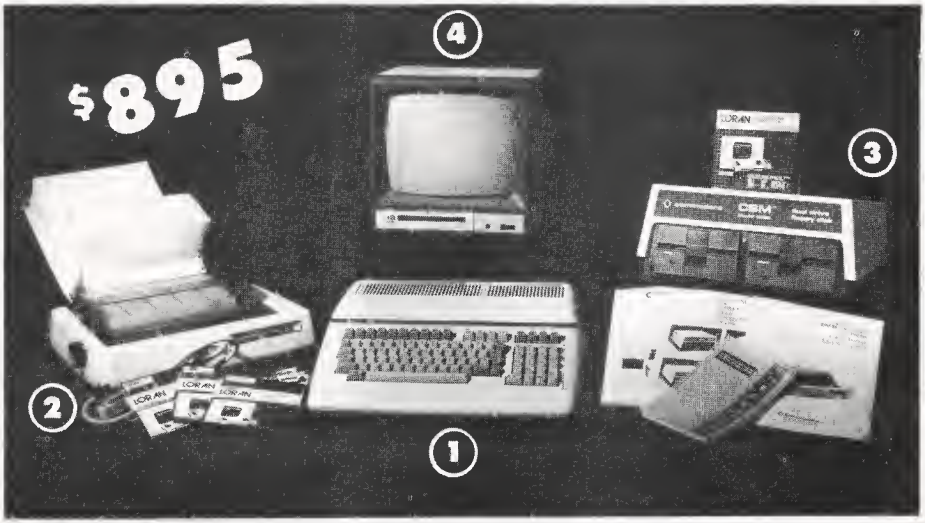

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- Sharp Clear Text
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9″ SANYO GREEN SCREEN DATA MONITOR List $149 **SALE $69**

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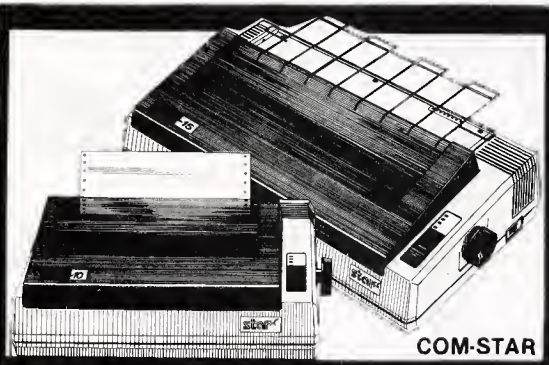

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only $ 169**

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10" COM-STAR PLUS+
Printer $249.00

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15½" COM-STAR PLUS+
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Has all the features of the 10" COM-STAR PLUS+ PRINTER plus 15½" carriage and more powerful electronics components to handle large ledger business forms! (Better than Epson FX 100) List $599
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COM-STAR PLUS+ Print Example: ABCDEFGHIJKLMNOPQRSTUVWXYZ
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COMMODORE-64 or VIC-20

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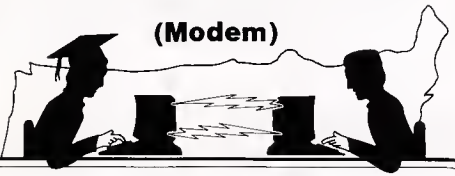
Sale



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Conic Curve Plotter

Lam-hing Wong

The Commodore 64 is a versatile and powerful computer, but its built-in BASIC has no commands for drawing high-resolution graphics. Here's a program that makes it easier to draw in hi-res by providing commands for a variety of geometric figures.

"Conic Curve Plotter" lets you create lines, angles, arcs, circles, ellipses, parabolas, and hyperbolas on the Commodore 64's high-resolution graphics screen at the touch of a key. It also lets you draw with the joystick and save your pictures on tape or disk.

The 64's hi-res screen normally has 320 horizontal pixels (screen dots) by 200 vertical pixels. In early versions of this program, lines looked like they were at off-angles and circles looked squashed. After taking some measurements with a ruler, I discovered that the length of 9 pixels vertically is equal to the width of 11 pixels horizontally. No wonder things looked skewed.

To remedy this problem, here are three types of screens. Screen 1 is the normal high-res screen with 320 pixels horizontally and 200 vertically. The dimensions of Screen 2 are 320 horizontal and 244 vertical (multiplying the normal vertical length by 11/9). If you want your drawings to appear undistorted, choose Screen 2. Screen 3 allows you to define your own dimensions. For example, you can stretch the drawing horizontally by setting the dimensions to 320 horizontal and 488 vertical.

The screen boundaries are checked for in all drawing modes except the joystick mode. When drawing lines, parabolas, or hyperbolas, the drawing can be stopped manually; otherwise, it stops when it reaches a border. When drawing

Figure 1: Demo-Screen 1

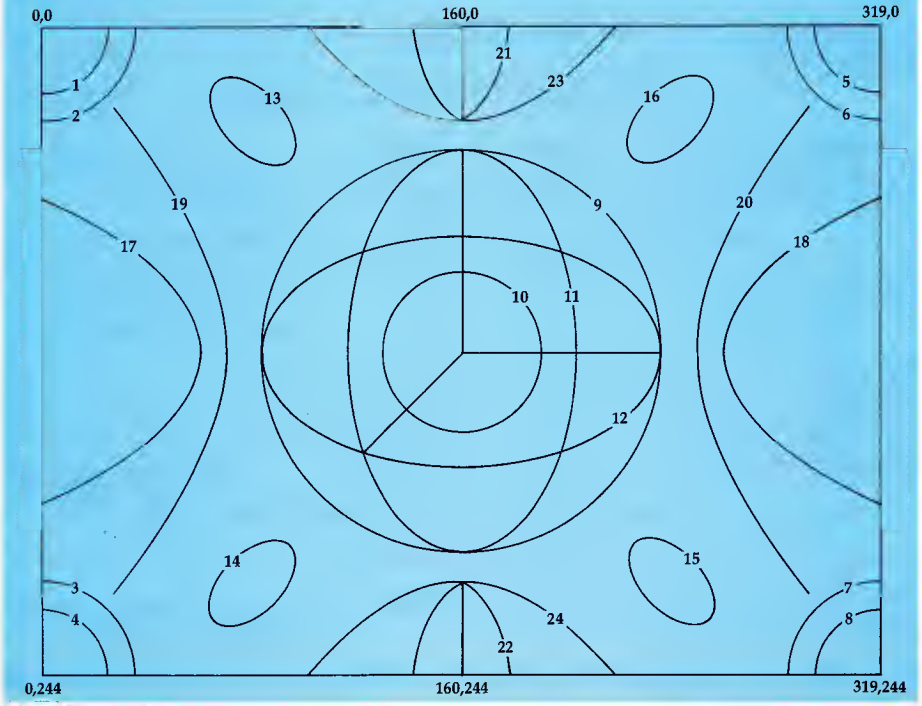

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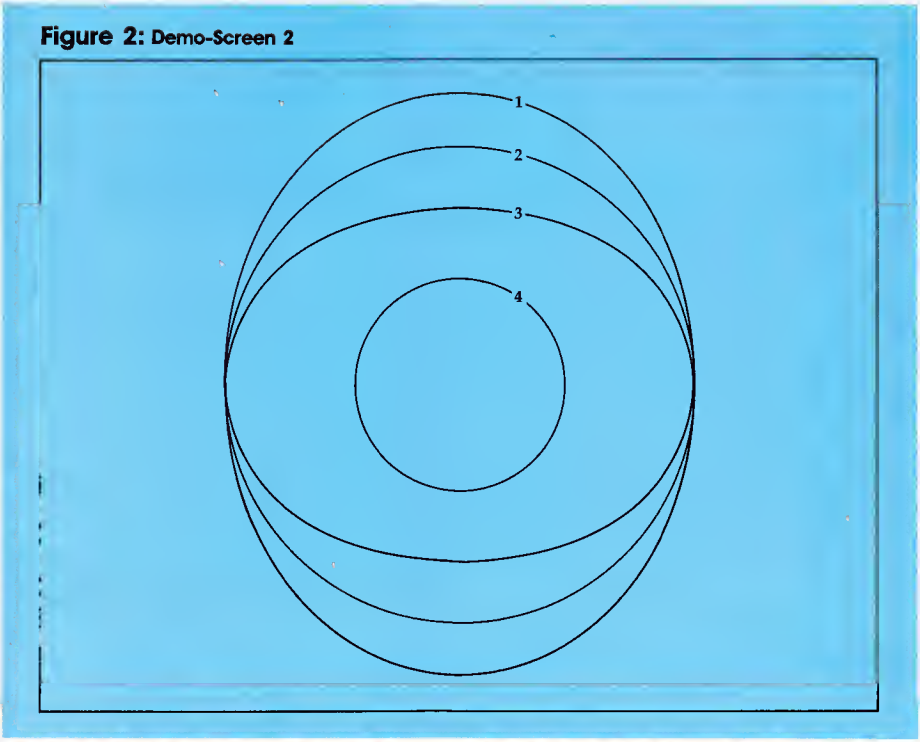
Figure 2: Demo-Screen 2



circles, arcs, or ellipses, you cannot stop the drawing manually. You can speed up the drawing by bypassing the boundary check routine. To do this, change these lines to REM statements: 638, 852, 975, and 4500. But be careful that the drawing does not go beyond the top border of the screen. If it does, the program might crash.

Originally, the program was written entirely in BASIC. It took 27 seconds to erase the high-resolution screen (POKEing locations 8192–16191 with 0), three seconds to set the bitmap background color to cyan (POKEing locations 1024–2023 with 3), and 25 minutes to save or load the screen on tape (using PRINT# and GET#). These time-consuming routines were replaced with machine language, and now clearing the screen and setting the background color are instantaneous. Using Kernal routines to save and load the screen on tape takes about four minutes.

Setting Things Up

At the beginning of the program, you are asked to select a type of screen. After you make your selection, the screen will clear and the high-res cursor (a small dot) will appear in the center. You are now ready to draw your picture using any of the one-key commands.

Several commands require that you enter additional information such as a screen position or angle. Screen position is specified by entering the X and Y coordinates. X is measured horizontally from the left of the screen. Y is measured vertically from the top of the screen. The top-left corner of the screen is position (0,0). Since the program does not check the coordinates of the points that you enter, be sure to confine them to the screen dimensions you have chosen. Angles are specified in degrees measured counterclockwise from the horizontal.

One-Letter Commands

Pressing A draws a line at a specified angle. You will be prompted for the starting point and the angle. The cursor will keep moving until it reaches the border or until you stop it by pressing any key.

Pressing O draws a line between two points. You will be prompted for the starting and ending points. The cursor can be stopped by pressing the f1 key. Pressing the f3 key switches the

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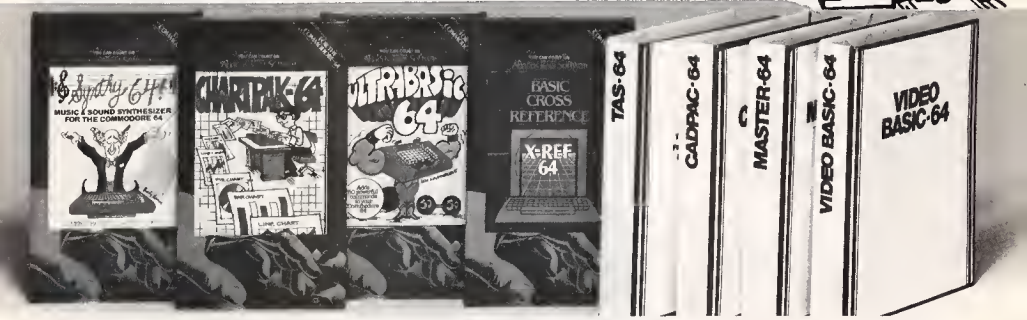

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draw/erase modes and reverses the direction of the cursor.

C draws a circle or arc. You must specify the radius, center, starting angle, ending angle, and density. To draw a circle, the starting and ending angles are 0 and 360, respectively. Enter a density between .1 and 1, or just hit RETURN to use the default value of .667. The density determines the spacing of the dots plotted. A low density will plot a few dots spaced far apart, while a high density will plot a lot of dots spaced close together.

Pressing I draws an ellipse. You must specify the parameters A and B in the equation X*X/A*A+Y*Y/B*B=1, the center, the angle of the major axis, and the density. A is half of the major (long) axis and B is half of the minor (short) axis. If A and B are equal, a circle will be drawn with A and B equal to the radius.

P draws a parabola. You will be prompted for the parameter A in the equation X=A*Y*Y, the vertex, the angle of the axis of symmetry, and the density. You can stop the drawing manually by pressing any key.

H draws a hyperbola. You must specify the parameters A and B in the equation X*X/A*A−Y*Y/B*B=1, the center, the angle of the transverse axis, and the density. Again, you can stop the drawing by pressing a key.

Q queries the location of the cursor, type of screen, and screen dimensions.

T changes the type of screen. This command is executed automatically at the beginning of the program. The previous drawings will not be affected.

M moves the cursor to a specified point. The CLR/HOME key moves the cursor to the top-left corner. Pressing SHIFT–CLR/HOME clears the screen and moves the cursor to the top-left corner.

S saves the screen to tape or disk. L allows you to reload a previously saved screen.

The / key ends the program. To restart the program, type GOTO 15. The previous drawings will not be lost.

Table 1: Demo-Screen 1

This table lists the data entered when drawing the curves on Demo-Screen 1. The screen dimensions are 320 × 244 (type 2).

Type Of Curve	Curve No.	Center Or Vertex	Parameters		Angles Init.	Angles Final	Density Of Points
arc	1	(0,0)	R=25		270	360	0.2
arc	2	(0,0)	R=35		270	360	0.2
arc	3	(0,244)	R=35		0	90	0.8
arc	4	(0,244)	R=25		0	90	0.8
arc	5	(319,0)	R=25		180	270	0.4
arc	6	(319,0)	R=35		180	270	0.4
arc	7	(319,244)	R=35		90	180	0.6
arc	8	(319,244)	R=25		90	180	0.6
circle	9	(160,123)	R=75		0	360	1.0
circle	10	(160,123)	R=30		0	360	0.1
			A:	B:	betw. major axis & horizontal:		
ellipse	11	(160,123)	75	40	90		0.667
ellipse	12	(160,123)	75	40	0		0.667
ellipse	13	(80,35)	20	13	135		0.2
ellipse	14	(80,210)	20	13	45		0.667
ellipse	15	(239,210)	20	13	135		0.4
ellipse	16	(239,35)	20	13	45		0.3
hyperbola	17,18	(160,123)	100	75	0		
hyperbola	19,20	(160,123)	85	73	0		
parabola	21	(160,40)	A=0.1		90		
parabola	22	(160,206)	A=0.1		270		
parabola	23	(160,40)	A=0.01		90		
parabola	24	(160,206)	A=0.01		270		

I used the O command to draw three lines that form the Cartesian coordinates. The starting and ending points are:

From (125,168) to (160,123)
From (160,123) to (160,48)
From (160,123) to (235,123)

You can use either the O command or the A command to draw the border lines and the axes of symmetry for the parabolas easily.

The program is divided into two parts. Program 1 POKEs the machine language routines into memory, and Program 2 is the main program. After you have the programs typed in and saved, you can activate "Conic Curve Plotter" by loading and running Program 1, then loading and running Program 2.

Programs 1 and 2 are designed for loading from and saving to tape. If you are using disk instead, make the modifications shown in Programs 3 and 4. Program 3 shows which lines must be changed in Program 1, and Program 4 gives the modifications for Program 2.

Sample Runs

To give you a better idea of how to use the program, Table 1 contains the information used to draw the curves shown in Figure 1. Figure 2 illustrates the effect of using different screen dimensions. Four circles were drawn using the C

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Table 2: Demo-Screen 2

On this screen, four shapes were drawn using the C command. Between drawings, the T command was used to redefine the screen dimensions.

Curve No.	Center	Radius	Density Of Points	Screen Dimensions
1	(160,100)	R=90	0.2	320 × 200
2	(160,123)	R=90	0.4	320 × 244
3	(160,160)	R=90	0.667	320 × 320
4	(320,244)	R=90	0.667	640 × 488

command. Between drawings, the T command was used to change the screen dimensions. The parameters used for each curve are given in Table 2.

The following is a line-by-line explanation of Program 2.

Lines	Explanation
14	Call machine language routine to clear high-res screen.
17	Turn on text mode.
18-19	Read joystick directional values.
20-30	Define screen dimensions.
35	Call machine language routine to turn on bitmap mode and set background color to cyan.
40-42	Define functions that calculate BY,BI given X,Y.
90-190	Joystick routine.
300-350	Check-boundary routine.
400-410	Take away the erased bit and POKE the byte with the remaining bits. Called whenever something needs to be erased.
600-640	Command A routine.
638	Call boundary-check routine.
800-860	Parabola routine.
900-990	Hyperbola routine.
960-972	Calculate and plot points on four branches.
1000-1190	Command O routine.
1100-1110	Determine horizontal and vertical increments: DX & DY.
1170-1176	Check to see if one component (x or y) has reached the end point.
1180	If S$ is f1, stop.
1182	If S$ is f3, reverse everything.
1200-1230	Command M routine.
1300-1400	Obtain data to draw circle, arc, or ellipse.
1405-1492	Calculate points of circle, arc, or ellipse. Notice that the FOR-NEXT loop is incremented by radians (DR), and that DR is a variable depending on a parameter specified by the user and on the radius.
1520-1550	Draw or erase an ellipse's foci.
3000-3080	Call machine language routines to save the high-res screen.
3100-3110	Call machine language routines to load the high-res screen.
3220-3250	Command Q routine—display cursor and screen dimension information.
4000-4570	This routine calculates points to be plotted or erased (takes rotating into account).
4450-4460	Calculates point positions after the axes were rotated.
4500	Call boundary-check routine.

If you don't want to type in the program, just send me $3, a blank cassette, and a self-addressed, stamped mailer. I will send you the program and two demo-screens along with full documentation.

Lam-hing Wong
5234 Gordon Avenue
El Cerrito, CA 94530

Program 1:
Conic Curve Plotter, Part 1

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

```
10 FORI=4936ØTO49461:READJ:POKEI,J:NEXT
                                    :rem 192
20 FORI=49485TO49623:READJ:POKEI,J:NEXT
                                    :rem 2Ø1
30 DATA173,Ø,192,133,Ø,173,2,192,133,2,17
   3,3,192,133,3,96,165,3,141       :rem 253
40 DATA3,192,165,2,141,2,192,165,Ø,141,Ø,
   192,96,Ø,165,3,141,3,192,165     :rem 96
50 DATA2,141,2,192,165,Ø,32,224,192,169,3
   2,133,3,169,Ø,133,2,133          :rem 1Ø1
60 DATAØ,164,Ø,162,Ø,145,2,23Ø,2,232,224,
   255,2Ø8,247,145,2,23Ø,3,169      :rem 37
70 DATA63,197,3,2Ø8,227,169,Ø,162,Ø,145,2
   ,23Ø,2,232,224,63,2Ø8,247,145    :rem 16Ø
80 DATA2,141,63,63,76,2Ø8,192       :rem 199
90 DATA32,224,192,169,59,141,17,2Ø8,169,2
   8,141,24                         :rem 172
100 DATA2Ø8,169,4,133,3,169,Ø,133,2,133,Ø
    ,162,Ø,164,Ø,169,3,145,2,23Ø    :rem 79
110 DATA2,232,224,255,2Ø8,247,145,2,23Ø,3
    ,169,7,197,3,2Ø8,225,169,3      :rem 17
120 DATA162,Ø,145,2,23Ø,2,232,224,231,2Ø8
    ,247,145,2,141,231,7,76,2Ø8,192
                                    :rem 239
130 DATAØ,Ø,Ø,Ø,32,224,192,16Ø,255,162,1,
    169,1,32,186,255,169,Ø          :rem 49
140 DATA32,189,255,169,Ø,133,2,169,32,133
    ,3,162,64,16Ø,63                :rem 37
150 DATA169,2,32,216,255,76,2Ø8,192,Ø,Ø,Ø
    ,Ø,Ø                            :rem 191
160 DATA169,1,162,1,16Ø,255,32,186,255,16
    9,Ø,32,189,255                  :rem 2Ø6
170 DATA169,Ø,162,Ø,16Ø,32,32,213,255,96
                                    :rem 217
```

Program 2:
Conic Curve Plotter, Part 2

```
14 SYS 49405                        :rem 1Ø6
15 POKE46,71:CLR:BASE=8192          :rem 2Ø
16 X=16Ø:Y=1ØØ:N=1:MODE$="DRAW":CP=53272:
   BM=53265:BO=PEEK(53265)AND223    :rem 33
17 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                    :rem 12
18 DIMX(11):DIMY(11):FORK=ØTO1Ø:READX(K),
   Y(K):NEXT                        :rem 47
19 DATA Ø,Ø,Ø,-1,Ø,1,Ø,Ø,-1,Ø,-1,-1,-1,1,
   Ø,Ø,1,Ø,1,-1,1,1                 :rem 9Ø
20 PRINTSPC(12)"{RVS}TYPE OF SCREEN:":PRI
   NT                               :rem 119
21 PRINT"1 - 'ORIGINAL SCALE' (32Ø,2ØØ)":
   PRINT"2 - 'REVISED SCALE' (32Ø,244)
                                    :rem 253
22 PRINT"3 - 'USER-DEFINED SCALE':rem 132
```

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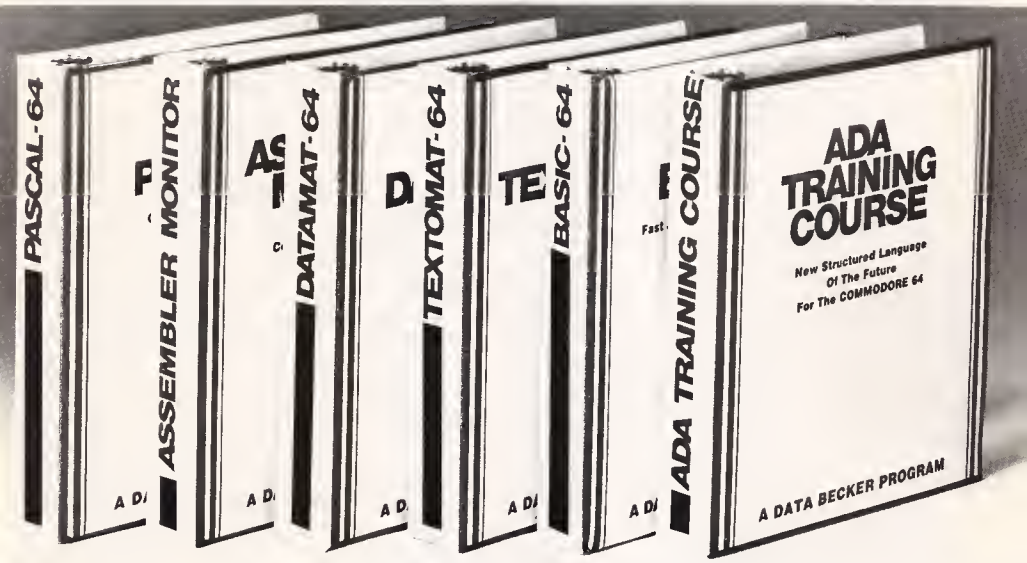

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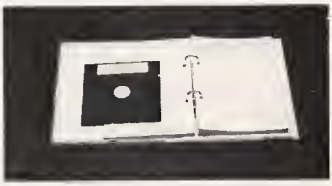

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```
24 PRINT:INPUTSCR:IFSCR=1THENXP=1:YP=1:GO
   TO30                                  :rem 48
26 IFSCR=2THENXP=1:YP=9/11:GOTO30 :rem 83
27 IFSCR=3THENPRINT:INPUT"DIMENSIONS (X,Y
   ):";XM,YM:IFXM=0ORYM=0THEN27    :rem 84
28 XP=320/XM:YP=200/YM:GOTO35      :rem 26
29 GOTO24                          :rem 10
30 XM=320:YM=INT(200/YP)          :rem 157
35 SYS 49485                      :rem 117
40 DEF FN FY(Y)=INT(Y/8)*320+(YAND7):DEF
   {SPACE}FN FX(X)=8*INT(X/8)     :rem 101
42 DEF FN B1(O)=FNFY(Y)+FNFX(X)+8192:DEF
   {SPACE}FN B2(X)=7-(7ANDX)       :rem 9
45 BY=FNB1(0):BI=FNB2(X):POKEBY,PEEK(BY)O
   R(2↑BI)                        :rem 202
50 GET F$                         :rem 175
60 IFF$="J"THEN90                 :rem 194
61 IFF$="O"THEN1000                :rem 32
62 IFF$="C"THEN1300                :rem 24
63 IFF$="I"THEN1320                :rem 33
64 IFF$="P"THEN800                :rem 251
65 IFF$="H"THEN900                :rem 245
66 IFF$="Q"THEN3200                :rem 43
68 IFF$="A"THEN600                :rem 238
70 IFF$="M"THEN1200                :rem 32
76 IFF$="{HOME}"THENX=0:Y=0:GOSUB400:GOTO
   45                              :rem 24
78 IFF$="{CLR}"THENSYS 49405:X=160:Y=100:
   GOTO 45                         :rem 83
80 IFF$="S"THEN3000               :rem 39
82 IFF$="L"THEN3100               :rem 35
86 IFF$="T"THENPOKECP,21:POKEBM,BO:PRINT"
   {CLR}":GOTO20                  :rem 228
88 IFF$="/"THEN5000               :rem 13
89 GOTO50                         :rem 15
90 J2=15-(PEEK(56320)AND15)       :rem 181
95 GETC$:IF C$=""THEN140          :rem 42
100 IFC$="D"THENMODE$="DRAW":GOTO140
                                  :rem 123
110 IFC$="E"THENMODE$="ERASE":GOTO140
                                  :rem 191
130 IFC$="{F1}"THENN=1-N:GOTO140 :rem 254
135 N=1:GOTO50                    :rem 45
140 IF J2 OR N THENJV=J2          :rem 23
150 X=X+X(JV):Y=Y+Y(JV)          :rem 149
160 IFMODE$="DRAW"THEN180         :rem 230
165 GOSUB400                      :rem 176
180 BY=FNB1(0):BI=FNB2(X)         :rem 172
190 POKEBY,PEEK(BY)OR(2↑BI):GOTO90
                                  :rem 138
300 IFX<0THENX=0:GOTO340          :rem 228
310 IFX>319THENX=319:GOTO340      :rem 193
320 IFY<0THENY=0:GOTO340          :rem 232
330 IFY>199THENY=199:GOTO340      :rem 209
335 O=0:GOTO350                    :rem 98
340 O=1                           :rem 84
350 RETURN                        :rem 120
400 PB=PEEK(BY)-(2↑BI):IFPB<0THENPB=0
                                    :rem 8
410 POKEBY,PB:RETURN              :rem 57
600 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 58
602 PRINTSPC(8)"{RVS}LINE AT AN ANGLE":PR
    INT                           :rem 100
606 X$="":Y$="":INPUT"STARTING POINT: (X,
    Y)";X$,Y$:IFX$=""ANDY$=""THEN620
                                  :rem 251
610 IFX=VAL(X$)ANDY=VAL(Y$)THEN615:rem 80
612 GOSUB400                      :rem 173
615 X=INT(VAL(X$)*XP):Y=INT(VAL(Y$)*YP)
                                  :rem 127
620 PRINT:INPUT"ANGLE: ";ANG:ANG=ANG*↑/18
    0                             :rem 249
625 GOSUB3360                     :rem 233
630 DX=COS(ANG):DY=-SIN(ANG)*YP/XP
                                  :rem 122
632 BY=FNB1(0):BI=FNB2(X):IFD=1THENPOKEBY
    ,PEEK(BY)OR(2↑BI):GOTO635     :rem 125
633 GOSUB400                      :rem 176
635 GETS$:IFS$<>""THEN50          :rem 135
638 GOSUB300:IFOUT=1THEN50        :rem 119
640 X=X+DX:Y=Y+DY:GOTO632          :rem 77
800 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 60
802 PRINTSPC(13)"{RVS}PARABOLA":PRINT
                                  :rem 33
805 PRINT"EQUATION OF PARABOLA: X=A*Y↑2;
    {SPACE}SPECIFY 'A'"           :rem 171
810 INPUT A:IFA=0THEN PRINT"USE 'O' OR 'A
    ' CMDS TO DRAW A LINE":GOTO 810:rem 8
818 SG=SGN(A):PRINT               :rem 185
820 INPUT"VERTEX: (X,Y)";CX,CY:CX=CX*XP:C
    Y=CY*YP:PRINT                  :rem 26
830 PRINT"SPECIFY THE ANGLE BETWEEN THE S
    YMMETRIC AXIS AND THE HORIZONTAL:"
                                  :rem 156
835 INPUTANG:ANG=ANG*↑/180         :rem 26
838 GOSUB3360                     :rem 239
840 GOSUB400:X=0                  :rem 175
845 Y=SQR(ABS(X/A)):GOSUB 4450:IFO=1THENO
    1=1                           :rem 151
848 Y=-Y:GOSUB4450:IFO=1THEN O2=1:rem 235
850 X=X+1*SG/XP                   :rem 129
852 IFO1+O2=2THENO1=0:O2=0:X=CX:Y=CY:GOTO
     45                           :rem 191
855 GETS$:IFS$<>""THENX=CX:Y=CY:GOTO 45
                                  :rem 15B
860 GOTO845                       :rem 120
900 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                   :rem 61
902 PRINTSPC(12)"{RVS}HYPERBOLA":PRINT
                                  :rem 133
905 PRINT"EQUATION OF HYPERBOLA: 'X↑2/A↑2
    -Y↑2/B↑2=1'; SPECIFY 'A','B' (A,B)"
                                  :rem 158
910 INPUTA,B:IFA=0ORB=0THENPRINT"A,B<>0":
    GOTO 910                       :rem 6
920 PRINT:PRINT"ANGLE BETWEEN THE TRANSVE
    RSE AXIS AND THE HORIZONTAL:":rem 191
930 INPUTANG:ANG=ANG*↑/180        :rem 22
940 PRINT:INPUT"COORDINATE OF CENTER (X,Y
    ) ";CX,CY:CX=CX*XP:CY=CY*YP    :rem 67
945 GOSUB3360:BY=FNB1(0):BI=FNB2(X):GOSUB
    400                           :rem 137
948 X=SQR(A↑2+B↑2):Y=0:GOSUB4450:X=-X:GOS
    UB 4450                       :rem 177
950 X=A                           :rem 116
960 Y=SQR((X↑2/A↑2-1)*B↑2):GOSUB4450:IFO=
    1THENO1=1                     :rem 57
962 Y=-Y:GOSUB4450:IFO=1THENO2=1  :rem 232
970 X=-X:GOSUB 4450:IFO=1THENO3=1:rem 230
972 Y=-Y:GOSUB4450:IFO=1THENO4=1  :rem 235
975 IFO1+O2+O3+O4=4THENO1=0:O2=0:O3=0:O4=
    0:X=CX:Y=CY:GOTO45            :rem 117
980 GET S$:IFS$<>""THENX=CX:Y=CY:GOTO45
                                  :rem 157
990 X=-X:X=X+1/XP:GOTO960          :rem 40
1000 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 101
1005 PRINTSPC(8)"{RVS}LINE BETWEEN TWO PO
     INTS":PRINT                  :rem 232
```

```
1010 X$="":Y$="":INPUT"STARTING POINT (X,
     Y) ";X$,Y$:PRINT                  :rem 80
1012 IFX$=""ANDY$=""THENX1=X:Y1=Y:GOTO102
     5                                 :rem 3
1015 IFX=VAL(X$)ANDY=VAL(Y$)THEN1020
                                       :rem 167
1016 GOSUB400                          :rem 220
1020 X1=INT(VAL(X$)*XP):Y1=INT(VAL(Y$)*YP
     ):X=X1:Y=Y1                       :rem 186
1025 INPUT"ENDING POINT (X,Y): ";X2,Y2:X2
     =INT(X2*XP):Y2=INT(Y2*YP)         :rem 244
1100 IFX2-X1=0THENDX=0:DY=SGN(Y2-Y1)*1:GO
     TO1120                            :rem 87
1106 SLP=(Y2-Y)/(X2-X):SY=SGN(Y2-Y):SX=SG
     N(X2-X)                           :rem 188
1108 IFABS(SLP)>1THENDY=SY*1:DX=SX*1/ABS(
     SLP):GOTO1120                     :rem 131
1110 DX=SX*1:DY=SY*ABS(SLP)            :rem 162
1120 GOSUB3360                         :rem 16
1130 BY=FNB1(0):BI=FNB2(X):IFD=1THENPOKEB
     Y,PEEK(BY)OR(2↑BI):GOTO1170       :rem 210
1140 GOSUB400                          :rem 218
1170 IFINT(X)<>X2THEN1174              :rem 236
1172 IFINT(Y)=Y2THEN45                  :rem 79
1173 Y=Y+DY:GOTO1180                   :rem 192
1174 IFINT(Y)<>Y2THEN1177              :rem 245
1175 IFINT(X)=X2THEN45                  :rem 80
1176 X=X+DX:GOTO1180                  :rem 192
1177 X=X+DX:Y=Y+DY                     :rem 117
1180 GETS$:IFS$="{F1}"THEN50           :rem 251
1182 IFS$="{F3}"THENDX=-DX:DY=-DY:X2=X1:Y
     2=Y1:D=1-D                        :rem 251
1190 GOTO1130                          :rem 201
1200 POKECP,21:POKE BM,BO:PRINT"{CLR}"
                                       :rem 103
1210 INPUT"CURSOR MOVES TO (X,Y): ";X2,Y2
     :X2=X2*XP:Y2=Y2*YP:SYS 494B5:rem 139
1220 GOSUB400                          :rem 217
1230 X=X2:Y=Y2:GOTO45                   :rem 28
1300 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                       :rem 104
1302 PRINTSPC(9)"{RVS}CIRCLE OR (ARC)":PR
     INT                               :rem 90
1304 PRINT"EQUATION OF CIRCLE: X↑2+Y↑2=R↑
     2. SPECIFY RADIUS(R):"            :rem 129
1305 INPUT R:PRINT                     :rem 114
1307 P=1:INPUT"COORDINATE OF CENTER: (X,Y
     ) ";CX,CY:CX=CX*XP:CY=CY*YP:PRINT
                                       :rem 163
1309 PRINT"INITIAL AND FINAL POLAR ANGLES
      OF MAPPING IN DEG.(INIT,FINAL)"
                                       :rem 110
1310 A1$="":A2$="":INPUTA1$,A2$:IFA1$=""A
     NDA2$=""THENA1=0:A2=2*↑:GOTO1360
                                       :rem 172
1315 A1=VAL(A1$):A2=VAL(A2$):IFA1>360ORA2
     >360THEN1310                      :rem 233
1316 IFA2<A1THENA2=A2+360              :rem 145
1318 A1=A1*↑/180:A2=A2*↑/180:GOTO1360
                                       :rem 106
1320 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                       :rem 106
1325 A1=0:A2=2*↑:PRINTSPC(14)"{RVS}ELLIPS
     E":PRINT                          :rem 125
1330 PRINT"EQUATION OF ELLIPSE: X↑2/A↑2+Y
     ↑2/B↑2=1; SPECIFY A,B (A,B):"
                                       :rem 125
1335 INPUTA,B:PRINT                    :rem 210
1336 IFA<BTHENPRINT"MINOR CANNOT BE GREAT
     ER THAN MAJOR":GOTO 1335          :rem 215
1338 IFA=0THENPRINT"CAN NOT HAVE 0 AS YOU
     R MAJOR AXIS.":PRINT:GOTO 1335
                                       :rem 232
1339 P=B/A:R=A                         :rem 25
1340 PRINT "ANGLE BETWEEN MAJOR AXIS AND
     {SPACE}HORIZONTAL ":INPUT ANG:ANG=AN
     G*↑/180                           :rem 73
1341 PRINT:INPUT"COORDINATE OF CENTER: (X
     ,Y)";CX,CY:CX=CX*XP:CY=CY*YP:PRINT
                                       :rem 112
1345 PRINT"WANT TO PLOT FOCI? (Y/N)"
                                       :rem 65
1350 GETD$:IFD$<>"Y"ANDD$<>"N"THEN1350
                                       :rem 152
1360 PRINT:PRINT"POINT DENSITY: (BETWEEN
     {SPACE}0.1 AND 1.0) - DEFAULT IS 0.6
     67."                              :rem 143
1370 V$="":INPUT V$                    :rem 10
1380 IFV$=""THENV=1.5:GOTO1400         :rem 228
1390 V=VAL(V$):IFV<.1ORV>1THENPRINT"OUT O
     F RANGE":GOTO1370                 :rem 102
1395 V=1/V                              :rem 27
1400 GOSUB3360                          :rem 17
1405 GOSUB400                          :rem 222
1430 DR=V/R                            :rem 114
1440 FORAG=A1TOA2STEPDR                :rem 207
1445 X1=X:X=R*COS(AG):DI=SGN(X-X1):GOTO14
     50                                :rem 125
1450 Y=SQR(R↑2-X↑2)*(P)*DI              :rem 32
1480 GOSUB4000                         :rem 17
1492 NEXT                              :rem 15
1500 IFF$="C"THEN1600                  :rem 121
1520 X=SQR(A↑2-B↑2):Y=0                :rem 116
1530 IF D=0ORD$="Y"THENGOSUB4450:X=-X:GOS
     UB4450                            :rem 67
1540 GOTO 1600                         :rem 202
1600 X=CX:Y=CY:GOTO45                  :rem 63
3000 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                       :rem 103
3005 SYS49558                          :rem 214
3008 SYS49485                          :rem 216
3080 GOTO50                            :rem 105
3100 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                       :rem 104
3105 SYS49600                          :rem 203
3106 SYS49485                          :rem 215
3110 GOTO50                             :rem 99
3200 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                       :rem 105
3210 PRINTSPC(3)"{RVS}YOU ARE USING SCREE
     N"SCR;:PRINT"{OFF}("XM","YM")":PRINT
                                        :rem 5
3220 PRINT"CURSOR POSITION: X="X/XP:PRINT
     SPC(17)"Y="Y/YP                   :rem 90
3230 PRINT:PRINT"HIT ANY KEY TO GET BACK
     {SPACE}TO BIT MAP MODE"           :rem 47
3240 GETD$:IFD$=""THEN3240             :rem 187
3250 SYS 49485:GOTO50                  :rem 175
3360 PRINT:PRINT"DRAW OR ERASE (D/E)";
                                       :rem 231
3370 GET DIR$:IFDIR$="D"THENMODE$="DRAW":
     D=1:SYS 49485:GOTO3390            :rem 221
3380 IFDIR$="E"THENMODE$="ERASE":D=0:SYS
     {SPACE}49485:GOTO3390              :rem 3
3385 GOTO3370                          :rem 217
3390 RETURN                            :rem 175
4000 IFF$="C"THENOX=X:X=X*XP+CX:Y=Y*YP+CY
     :GOTO4500                         :rem 170
4450 XA=(X*COS(ANG)+Y*SIN(ANG))*XP:rem 19
4460 YA=(-X*SIN(ANG)+Y*COS(ANG))*YP
                                       :rem 67
4470 OX=X:OY=Y:X=XA+CX:Y=YA+CY         :rem 226
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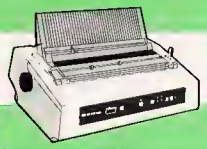

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```
4500 GOSUB300:IFO=1THENGOTO4570   :rem 154
4505 BY=FNB1(0):BI=FNB2(X)        :rem 225
4510 IFD=1THENPOKEBY,PEEK(BY)OR(2↑BI):GOT
     O4570                        :rem 145
4550 GOSUB400                     :rem 226
4570 X=OX:Y=OY:RETURN             :rem 158
5000 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 105
5010 PRINT"TYPE 'GOTO 15' TO RE-ENTER THE
      PROGRAM":END                :rem 181
```

Program 3:
Changes For Disk In Program 1

```
20 FORI=49485TO49633:READJ:POKEI,J:NEXT
                                  :rem 202
130 DATA0,0,0,0,160,255,162,8,169,1,32,18
    6,255,169,2,162,61            :rem 117
140 DATA160,193,32,189,255,169,0,133,251,
    169,32,133,252,162,64,160,63 :rem 125
150 DATA169,251,32,216,255,96,0,0,0,0,0,0
    ,169,1,162,8,160,1,32,186     :rem 195
160 DATA255,169,2,162,61,160,193,32,189,2
    55,169,0,162,255,160,255,32,213
                                  :rem 21
170 DATA255,169,64,170,169,63,168,96
                                  :rem 59
```

Program 4:
Changes For Disk In Program 2

```
3000 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 103
3005 INPUT"SCREEN NUMBER (0-99)";SN
                                  :rem 33
3010 L=INT(SN/10):R=SN-L*10:POKE49469,L+4
     8:POKE49470,R+48             :rem 54
3020 IFL=0THENPOKE49469,32        :rem 12
3030 SYS49558                     :rem 212
3040 SYS49485                     :rem 212
3080 GOTO50                       :rem 105
3100 POKECP,21:POKEBM,BO:PRINT"{CLR}"
                                  :rem 104
3105 INPUT"SCREEN NUMBER (0-99)";SN
                                  :rem 34
3110 L=INT(SN/10):R=SN-L*10:POKE49469,L+4
     8:POKE49470,R+48             :rem 55
3120 IFL=0THENPOKE49469,32        :rem 13
3130 SYS49600                     :rem 201
3140 SYS49485                     :rem 213
3150 GOTO50                       :rem 103
5005 POKE46,31                  :rem 243 ©
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The Basics Of Commodore 64 Hi-Res Graphics

David Martin

Creating an interesting high-resolution screen on the Commodore 64 can be a chore. These short programs will make it easier to design detailed screens for your games or business applications. Program 1 is in BASIC so it can be easily modified and understood. Program 2 demonstrates some of the potential of the VIC-II chip.

High-resolution screens use a technique called bitmapping. That's just a different way of setting up a display screen. In bitmap mode, the VIC-II chip displays an 8K section of memory on your screen instead of the normal 1K for a text screen. The reason for this is that in bitmap mode you need eight bytes for each character space on the screen. It's like having 1000 redefinable characters on the screen at one time.

A standard text screen is 25 by 40 characters wide. If you could fill that standard text screen with a thousand redefinable characters, you would have a screen that could be easily bitmapped. The bitmap mode enables you to turn on individual pixels on the screen and create intricate graphs and game backgrounds.

In bitmap mode the screen is divided into 320 horizontal pixels by 200 vertical pixels, each of which can be turned on and off individually. The formulas in line 10 of Program 1 do all the calculation that is necessary to turn on the pixel that you prefer. The reason that formulas are necessary is that the pixel locations are not continuous (right to left and top to bottom). Instead, they are located eight bits across and eight bytes down, then back up to the top byte of the next character space.

For example, say that you wanted to turn on a complete row of pixels to form a horizontal line. You would first have to turn on the first eight bits by POKEing a 255 into the first memory location of the high-resolution screen area, then skip the next seven bytes and POKE 255 into the eighth byte, and follow this pattern 40 times to create the line. In any case, the formulas in line 10 will figure out which pixel you want to turn on.

Erasing Program Lines

To use bitmapped graphics, you will have to know not only how to set pixels, but also how to set up an 8000-byte section of memory for the bitmap and a 1K section of memory for the background color screen. This involves working with the VIC-II chip. In Program 1 the text screen is used as the background color screen, and the section of memory starting at location 8192 for the bitmap. Lines 3 and 4 in Program 1 take care of this. The bitmap could have been moved to another section of memory, but that would have involved several extra steps, such as telling the VIC-II chip to look at the second 16K bank of memory. For short programs this is not necessary. Program 1 makes itself shorter using a technique called the "Electric Eraser," which appeared in the August 1982 issue of COMPUTE!. You will find the routine that does this in line 96 of the program. After the data for two short machine language routines has been placed into memory, the Electric Eraser erases everything after line 94 (so remember to save the program before running it).

The first of the machine language routines in Program 1 is used for erasing the 8K bitmapped screen. The second routine sets the background color of the hi-res screen to whatever color you specify by filling the background color screen with the value for the desired color. Both programs are very similar; they are just general

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transfer routines that could be used for other purposes. If these routines had not been included, you would have had to wait about 40 seconds while the entire hi-res screen cleared. In machine language, the clearing is almost instantaneous.

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

Program 1: Hi-Res Screen Sketching

```
0 POKE56,32:POKE52,32:CLR:REM PROTECT SCR
  EEN FROM BASIC                    :rem 108
1 POKE53280,1:PRINT"{CLR}{WHT}":GOTO100
                                    :rem 102
2 GOSUB26:BASE=2*4096:REM START ADDRESS O
  F HIRES SCREEN                    :rem 93
3 POKE53272,PEEK(53272)OR8:REM BIT MAP AT
   8192                             :rem 39
4 POKE53265,PEEK(53265)OR32:REM BIT MAP O
  N                                 :rem 141
5 SYS49152:REM CLR HIRES SCREEN     :rem 115
6 SYS49173:REM SET SCREEN COLOR (BITS THA
  T ARE OFF)                        :rem 237
7 X=160:Y=100:REM X & Y START POSITIONS
                                    :rem 15
8 GOSUB13:REM READ JOYSTICK         :rem 198
9 REM UPDATE SCREEN                 :rem 160
10 CH=INT(X/8):RO=INT(Y/8):LN=YAND7:BY=BA
   SE+RO*320+8*CH+LN:BI=7-(XAND7)   :rem 90
11 POKEBY,PEEK(BY)OR(2↑BI):GOTO8    :rem 33
12 REM READ JOYSTICK                :rem 211
13 JV=PEEK(56320):FR=JVAND16        :rem 160
15 X=X+((JVAND4)=0)-((JVAND8)=0)    :rem 27
16 Y=Y+((JVAND1)=0)-((JVAND2)=0)    :rem 21
19 IFFR=0THEN5                      :rem 98
20 IFX>319THENX=319                 :rem 133
21 IFY>199THENY=199                 :rem 148
22 IFX<0THENX=0                     :rem 171
23 IFY<0THENY=0                     :rem 174
24 GETA$:IFA$<>"Q"THENRETURN        :rem 247
25 POKE56,160:POKE52,160:POKE53272,21:POK
   E53265,27:PRINT"{CLR}":END       :rem 4
26 PRINT"{CLR}"TAB(18)"{DOWN}MENU{DOWN}
   {4 LEFT}{4 Y}"                   :rem 72
27 PRINT "{DOWN}"TAB(16)"Q{2 SPACES}-QUIT
   "                                :rem 223
28 PRINT"{DOWN}"TAB(9)"FIRE BUTTON- CLR S
   CREEN"                           :rem 193
29 PRINT"{DOWN}"TAB(10)"JOYSTICK MOVES LI
   NE."                             :rem 106
30 PRINT"{3 DOWN}{7 RIGHT}ENTER BORDER CO
   LOR (0 TO 15).":PRINTSPC(18);    :rem 71
31 INPUTBC:POKE532B0,BCAND15        :rem 206
32 PRINT"{3 DOWN}{7 RIGHT}ENTER SCREEN CO
   LOR (0 TO 15).":PRINTSPC(18);    :rem 75
33 INPUTSC:POKE49174,SCAND15:RETURN
                                    :rem 19
94 END:REM ELECTRIC ERASER          :rem 111
95 A=PEEK(61)+256*PEEK(62)+3:POKE7B6,INT(
   A/256):POKE785,A-256*PEEK(786)   :rem 3
96 POKEA-2,0:POKEA-1,0:POKE45,PEEK(7B5):P
   OKE46,PEEK(786):CLR:GOTO95       :rem 44
100 FORI=0TO42:READJ:POKE49152+I,J:NEXTI:
    GOTO2                           :rem 150
101 DATA169,0,162,32,160,0,132,33,134,34,
    145,33,200,208,251,232,224,64,208,244
                                    :rem 17
102 DATA96,169,1,162,4,160,0,132,33,134,3
    4,145,33,200,20B,251,232,224,8,208,24
    4                               :rem 75
103 DATA96,0                        :rem 121
```

Program 2: Multicolor Hi-Res Screen

```
1 PRINT"{CLR}"                      :rem 149
2 BASE=10*4096:REM START OF HIRES SCREEN
                                    :rem 100
3 POKE 53272,PEEK(53272)OR10:REM PUT BIT
  {SPACE}MAP AT 40960               :rem 120
4 POKE53265,PEEK(53265)OR32:REM ENTER BIT
   MAP MODE                         :rem 147
5 POKE 53270,PEEK(53270)OR16:REM MULTI-CO
  LOR ON                             :rem 2
6 POKE 56576,5:REM SELECT VIDEO BANK
                                    :rem 68
7 FORI=BASETOBASE+7999:POKEI,0:NEXTI:REM
  {SPACE}CLEAR GRAPHIC SCREEN       :rem 157
8 END                               :rem 15
```

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Atari's "Hidden" Character Modes

Sheldon Leemon

Atari's graphics modes are much more flexible than many programmers realize. The Atari keeps a list of numbers to tell itself which graphics mode to display, and you can change these numbers to suit yourself. Try these example programs to see how to create realistic lowercase letters and colorful high-resolution graphics.

The GTIA chip (or CTIA in early Atari models) is the heart of your computer's graphics system, but it can't do the job on its own. Another chip, called ANTIC, feeds instructions to the GTIA. The ANTIC chip is like a video microprocessor. It has its own set of instructions, like a mini-language, to let you program a variety of screen displays. For example, you can mix any two graphics modes on the same screen or even several modes simultaneously.

This set of instructions for the ANTIC chip is called the *display list*. It's basically a video program. Each instruction controls one vertical portion of the screen, from one to eight scan lines. The display list is set up for you by the operating system in graphics modes 1 through 12, but much more flexibility is possible.

By altering the existing display list with a series of POKEs, you can combine any graphics modes onscreen at the same time. The key step involves changing the display instruction, which is a number from 2 to 15. The display instruction number tells the computer which graphics mode to display on that part of the screen.

However, the display instruction number used by ANTIC does not directly correspond to the number of the graphics mode. For example, to display a line of GRAPHICS 0, you wouldn't POKE a 0 for the display instruction; you'd POKE a 2. Likewise, POKEing a 6 orders up one line of GRAPHICS 1; POKEing a 7 makes one line of GRAPHICS 2, etc. Notice how the display instruction numbers 3, 4, and 5 were skipped? These instructions let you access graphics modes that are not available any other way in Atari BASIC. What kind of modes do these numbers produce?

These special modes are not documented in the usual Atari manuals. Instead, you must turn to the *Atari Hardware Manual*. This manual, along with the *Operating System User's Manual*, has been available from Atari and can be found at some computer dealers. It's fairly technical, but it does outline some hardware features not explained in the reference material supplied with the computer.

Creating True Descenders

Two short programs following this article help explain the nature of the "hidden" modes. Program 1 demonstrates the first of these modes, designated by Atari as *Instruction Register (IR) Mode 3*. Notice line 10: The IR number 3 is POKEd into bytes 19–26 of the display list, producing a screen which is half graphics mode 0 and half IR mode 3. Next, the whole character set is printed in both modes (line 30). Finally, the program prints a few adjacent characters in both modes for the purposes of comparison (lines 40–45).

When this program is run, the IR mode 3 characters at the bottom of the screen appear no different from the GRAPHICS 0 characters at the top. On more careful examination, however, some differences can be detected. First, there is more room between the rows of characters in IR mode 3. The four diagonal graphics characters in the middle of the screen form a diamond shape in GRAPHICS 0, but in IR 3 there is a gap between the top and bottom triangles and in the taller cursor. The second difference occurs only in the last 32 characters of the IR 3 character set. These characters appear to be shifted, so that the top of the character has been cut off and moved below the bottom of the character, invalidating the top row, but simulating a ninth row for these characters.

According to the *Atari Hardware Manual*, there is a simple reason for these differences. By creating a longer block for these characters, and having some appear at the top of the block and some at the bottom, one can create a custom character set with true descenders for lowercase

letters like *y* and *p* (a *descender* is the tail which protrudes below the line on letters such as *y*, *p*, and *q*).

To explain exactly how this mode accommodates these changes, however, we must first review the method by which the computer determines the shape of a character. The data for character shapes is stored in ROM (Read Only Memory), starting at memory location 57344. Each character is represented by eight bytes of data. Since each of these bytes is composed of eight binary digits (or bits), we can picture this data in the form of an 8 × 8 grid.

Figure 1 shows how the data for the upper- and lowercase letter L is translated into the character seen on the screen. In this drawing, each horizontal row represents one byte (the numeric value is given on the left). Each vertical column represents a bit place. A darkened square represents a 1, or "on-bit," in the corresponding bit location (the bit values, which equal the successive powers of 2 from 2^0 [a value of 1] to 2^7 [a value of 128] are shown at the top of each column). For example, no squares are darkened in the top row of Figure 1a; therefore, the first byte has a value of 0. In the second through sixth rows, where bits 5 and 6 are darkened, the byte value is 96 (32+64); in the seventh row, where bits 1, 2, 3, 4, 5, and 6 are darkened, the byte value is 126 (2+4+8+16+32+64). Finally, in the eighth row, no bits are darkened and the byte value is again 0.

In IR mode 3, however, these same characters are set up in a 10 × 8 grid. Two blank scan lines are inserted below each of the first 96 characters—see Figure 2a. The last 32 characters, which include the lowercase alphabet, receive special handling. When one of these characters is set up in the grid, the first two bytes are shifted down to the bottom two lines—see Figure 2b. This shift of the last 32 characters means that they use the bottom eight lines of the grid, while the other characters use the top eight lines, thus permitting the two bottom lines to be used for descenders.

Multicolor Characters

This leaves us with IR modes 4 and 5 to explore. These are demonstrated by Program 2. Lines 10–20 set up half the screen in IR 4 and half in IR 5. Line 30 prints the full character set in each mode. Line 40 changes the background color for better visibility. The rest of the program lets you use the console buttons to change the color and luminance values of each color register. The SELECT button determines the register, START changes the color of that register, and OPTION the brightness.

These two modes are four-color character modes. The only difference between them is that IR 5 characters are twice as high as those of IR 4. The new Atari 600XL and 800XL computers support these multicolor character modes as GRAPHICS 12 and 13, but the older Atari BASIC on cartridge lacks these modes. The only way to access them on an Atari 400, 800, or 1200XL is to modify the display list with the POKEs used here. Even if you have a 600XL or 800XL, you should stick to this POKE method if you want your programs to run on all Atari models.

Easy Hi-Res Graphics

The purpose of these colorful characters may not be obvious. When I first saw them while

Figure 1: GRAPHICS 0 Characters

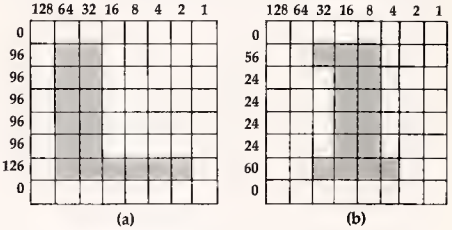


Figure 2: IR Mode 3 Characters

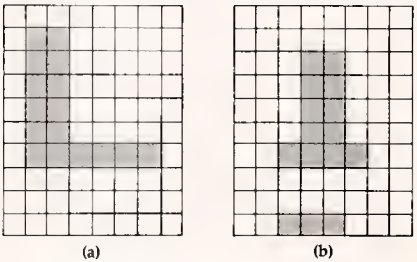
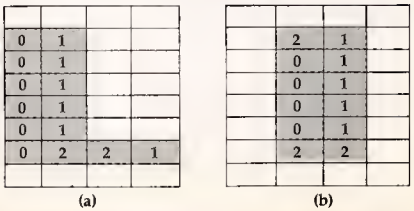


Figure 3: Multicolor Characters



The numbers in the darkened squares indicate the color register used.

experimenting a couple of years ago, I thought that a three-dimensional effect might be achieved with shading. Then it occurred to me that character modes are useful for displaying not only letters, but also graphics characters. Each of these characters can be used in combination with others to form a bigger picture. This is an easy method for producing high-resolution graphics. Each time you need the drawing, just print a string of characters.

Although Atari provides some graphics characters with the standard character set, you are perfectly free to design your own custom graphics characters. In GRAPHICS 0, these characters are all the same color, and you can achieve the same resolution with custom GRAPHICS 0 characters as you can in GRAPHICS 8 (the normal hi-res 320 × 192 graphics mode). With IR modes 4 and 5, however, these hi-res characters can be created in four colors. I have seen this technique used to create dazzling animation of detailed color figures.

These character modes differ from the others in that each byte of character display data is divided into four groups of two bytes each. These groups determine the color of the four pixels per row. The four possible combinations produce the following colors:

- Neither bit set (00) displays the background color (register 4).
- Right bit set (01) displays the color in register 0.
- Left bit set (10) displays the color in register 1.
- Both bits set (11) displays the color in register 2 for normal characters, and the color in register 3 for inverse characters.

Because two bits are needed to determine the color of each pixel, the horizontal resolution is cut in half. Figure 3 shows how this affects letters in the existing character set. You should be able to verify this effect by changing the color registers in the demonstration program by pressing the console buttons as explained above.

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering these listings.

Program 1: IR Mode 3

```
IH 5 REM ** SET UP MIXED-MODE SCRE
     EN
GO 6 REM **
EI 10 ? CHR$(125):X=PEEK(560)+PEEK
     (561)*256+19:FOR I=0 TO 7:PO
     KE X+I,3
JC 20 NEXT I:POKE X+8,65:POKE X+9,
     PEEK(560):POKE X+10,PEEK(561
     )
HB 21 REM *
OB 25 REM * SET UP COMPARISON CHAR
     ACTERS
HG 26 REM *
NO 30 GOSUB 60:POSITION 2,17:GOSUB
      60
IO 40 POSITION 10,12:? CHR$(6);CHR
     $(7)
LA 41 POSITION 10,13:? CHR$(7);CHR
     $(6);"L1";CHR$(160)
DE 45 POSITION 10,14:? CHR$(6);CHR
     $(7);"{5 SPACES}";CHR$(160);
     "L1"
PG 46 POSITION 10,15:? CHR$(7);CHR
     $(6):POSITION 15,10:? " "
AK 50 POKE 752,1:POSITION 2,9:? CH
     R$(28)
HE 51 REM *
AN 55 GOTO 55
HJ 56 REM *
GB 60 FOR I=0 TO 127:? CHR$(27);CH
     R$(I);:NEXT I:RETURN
```

Program 2: IR Modes 4 & 5

```
LA 5 REM ** SET UP MIXED MODE DISP
     LAY
GO 6 REM **
CI 10 ? CHR$(125):X=PEEK(560)+PEEK
     (561)*256+3:POKE X,69
HK 15 FOR I=3 TO 8:POKE X+I,5:NEXT
      I:FOR I=9 TO 16:POKE X+I,4:
     NEXT I
GK 20 POKE X+19,65:POKE X+20,PEEK(
     560):POKE X+21,PEEK(561):POK
     E 752,1:? "{UP}"
HB 21 REM *
MO 25 REM * PRINT CHARACTER SETS
HG 26 REM *
GN 30 GOSUB 60:? :? :GOSUB 60:POSI
     TION 0,0:? CHR$(156):POSITIO
     N 1,13
HC 31 REM *
HL 35 REM * CHANGE BACKGROUND COLO
     R
HH 36 REM *
KE 40 FOR DELAY=1 TO 1500:NEXT DEL
     AY:? CHR$(253):SETCOLOR 4,0,
     14
HO 41 REM *
CH 45 REM * COLOR REGISTER CHANGE
     ROUTINE
HI 46 REM *
EE 50 R=0:S=5:GOSUB 70
DC 52 S=PEEK(53279):IF S=5 THEN R=
     R+1-5*(R=4):GOSUB 70
AF 54 IF S=6 THEN C=C+1-16*(C=15):
     SETCOLOR R,C,L:GOSUB 75
BL 56 IF S=3 THEN L=L+2-16*(L=14):
     SETCOLOR R,C,L:GOSUB 80
PL 58 FOR DELAY=1 TO 50:NEXT DELAY
     :GOTO 52
EI 60 FOR I=1 TO 154:? CHR$(27);CH
     R$(I);:NEXT I
NE 65 FOR I=156 TO 255:? CHR$(27);
     CHR$(I);:NEXT I:RETURN
GN 70 M=PEEK(708+R):C=INT(M/16):L=
     M-16*C
LC 71 POSITION 2,15:? "REGISTER ";
     R:GOSUB 75:GOSUB 80:RETURN
CM 75 POSITION 15,15:? "COLOR ";C;
     "  ":RETURN
MP 80 POSITION 25,15:? "LUM. ";L;"
       ":RETURN
```

©

IBM Personalized Form Letters

Donald B. Trivette

If you've ever needed to mail copies of the same letter to a number of people—for holiday greetings, notices of club meetings, or whatever—you'll appreciate this labor-saving program. It automatically retrieves addresses and salutations from disk and prints them atop your form letter. The program requires an IBM PC or PCjr with BASICA or Cartridge BASIC, a disk drive, and a printer. A word processor that saves standard ASCII files is recommended.

'Tis the season to be jolly. 'Tis also the season to send out holiday cards and letters. You remember Christmas letters, those mimeographed missives that let your archfriends know how well you're doing—or how well you want them to *think* you're doing. Perhaps you've not participated in this holiday ritual because it's just too much trouble to duplicate and address 50 letters—and besides, mimeographed letters are so impersonal.

Now, with the assistance of your IBM PC or PCjr, you too can practice creative writing. The BASIC program following this article automatically merges an address list with a letter to produce a *personalized* form letter. It's guaranteed to speed up your holiday correspondence and leave your recipients wondering whether they were form-lettered or not.

Of course, "IBM Personalized Form Letters" isn't limited to holiday greetings. You might use this program to contact everyone in the neighborhood about the proposed zoning change to put a nuclear waste dump adjacent to the playground, or to keep the members of the garden club or user group informed about the next meeting. If you occasionally need to send the same letter to many people, and don't want to invest in a commercial form-letter program, then read on.

Standard ASCII Files

IBM Personalized Form Letters is only 76 lines long (53 if you leave out the comments at the beginning). It uses the input from two files, files that you must create using a word processor, a text editor, or the DOS utility program EDLIN. However the files are created, they must be standard ASCII text. (Sorry, *WordStar* fans.)

One file contains an exact image of the letter. This means that if you're using a word processor to create the letter, you must *not* count on it to format the lines, insert spaces, and adjust the right margin. Instead, *you* must decide how many characters to put on each line of the letter; you must format it manually. If your word processor automatically wraps words from one line to another, as most do, you'll need to defeat that feature. For example, text with 50 characters on a line is about right for standard margins, so when a line of text reaches column 50, press the Enter key and start the next line. In other words, type the letter just as you would on an old-fashioned typewriter.

Personalized Form Letters is a dumb program. It won't understand the special codes that switch on boldface printing, underlining, centering, or any of the fancy things your word processor can do. It just reads a line from a file and prints it.

But it's not completely stupid, either. It does know enough to print one letter for each address in the address file. How do you signal the computer where to put the address? Insert <<>> at the proper location in the letter and the program will replace it with a four-line address, a blank line, the salutation, and another blank line. For example:

```
700 Maple Avenue
Anywhere, NC 27900
December 10, 1984

<<>>
Hi. We've had a wonderful year . . . . Made so
much money
that we don't know how we'll ever spend it . . . .
```

By inserting a few blank lines ahead of your own address, you can position the letter so the recipient's address appears through a window

envelope when the paper is folded. The program automatically reprints the first letter until you get it properly aligned. (Maybe you can find red window envelopes for the holidays.)

The Address List

The second ASCII file required by the program contains the address list. Again, you may use a word processor to build and maintain the file. Remember to press the Enter key after each line in the address. Personalized Form Letters is designed to use a four-line address and a one-line salutation. The salutation—*Dear Bob & Ann,*—adds a personal touch. Insert a blank line between each address/salutation group. That's to make it easier for you to separate one address from another when editing the address file. Here's an example of how two addresses would look:

Mr. and Mrs. Bob Adams
123 Main Street
Westover, NH 93939

Dear Bob and Ann,

Dr. and Mrs. Robert Brown
Apartment 203
7000 Southfork Avenue
Snake Bluff, CO 94959
Dear Bob & Carol & Ted & Alice,

Notice that the Adams' address is only three lines long, so a blank line is entered as the fourth line of their address.

Personalized Form Letters is designed to print on continuous-forms paper. Who wants to feed in 50 sheets one at a time? You do? Then insert two lines in the program:

```
374 PRINT "Insert paper and press any key."
375 B$=INKEY$:IF B$="" THEN 375
```

and it will pause after printing each letter.

Type the BASIC program exactly as it's shown (we recommend using the "IBM Automatic Proofreader" to avoid typos). Save it. Then create your letter and address files as described above. Next, return to BASIC and run the program with those files as input. One important point: You must use Advanced BASIC (BASICA) or PCjr Cartridge BASIC when running this program (ordinary BASIC will result in a syntax error in line 560).

Happy holidays.

IBM Personalized Form Letters

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
IL 10 REM IBM Personalized Form Letter
      s
GB 20 REM
OI 30 REM A progrem to print form lett
      ers using
QL 40 REM addresses from an address fi
      le with
BE 50 REM the following formet:
MF 60 REM Address line 1
PL 70 REM Address line 2
AB 80 REM Address line 3
BH 90 REM Address line 4
HC 100 REM Salutetion
FG 110 REM (blenk line to seperete one
JI 120 REM eddress from enother)
DK 130 REM
LO 140 REM The letter file is en ASCII
       file
MD 150 REM conteining the form letter.
AA 160 REM
IN 170 REM Use <<>> to indicete where
       the
HI 180 REM address/selutetion is to ep
       pear in the
FC 190 REM letter. The progrem eutomet
       ically
GM 200 REM inserts e blenk line before
       and efter
MC 210 REM the selutetion.
QJ 220 REM
CA 230 REM ---------------
NH 240 KEY OFF:CLS
FJ 250 ON ERROR GOTO 730
JM 260 PRINT
FL 270 PRINT"IBM Personalized Form Let
       ters"
JB 280 PRINT
MO 290 LINE INPUT "Enter eddress filen
       eme: ";ADD$
IN 300 LINE INPUT "Enter letter filene
       me : ";LETR$
DL 310 LINE INPUT "Enter left mergin v
       alue: ";N$
GI 320 N=VAL(N$)
ME 330 I=0
II 340 CLOSE #2:OPEN ADD$ FOR INPUT AS
       #2
JM 350 CLOSE #1:OPEN LETR$ FOR INPUT A
       S #1
DH 360 IF I<2 THEN GOSUB 580
PF 370 LPRINT CHR$(12)  'skip to top o
       f pege
NK 380 IF EOF(1) THEN GOTO 350
QP 390 LINE INPUT #1, A$
CM 400 IF A$="<<>>" THEN GOSUB 440  'p
       rint address
NL 410 LPRINT SPC(N)A$
HP 420 GOTO 380
FB 430 REM ---GOSUB to print eddress--
       -
BL 440 I=I+1            'count of letters
OE 450 FOR J=1 TO 4   '4-line eddress
HG 460 IF EOF(2) THEN PRINT:PRINT I-1;
       " Letters printed.":END
FI 470 LINE INPUT #2,A$
AG 480 LPRINT SPC(N)A$  'print on prin
       ter
EK 490 PRINT A$           'print on scre
       en
MF 500 NEXT J
MH 510 LPRINT:PRINT
MK 520 LINE INPUT #2,A$  'selutetion
MA 530 LPRINT SPC(N)A$
MM 540 LPRINT:PRINT
```

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Bank of America

```
KI 550 LINE INPUT #2, A$ 'throw away b
       lank line
AH 560 RETURN 380
KO 570 REM ---GOSUB to line up letter-
       --
EN 580 IF I<>0 THEN GOTO 630
MN 590 PRINT "Switch on printer and pr
       ess any key to continue."
IF 600 PRINT
MJ 610 B$=INKEY$:IF B$="" THEN GOTO 61
       0
ME 620 RETURN
LI 630 LPRINT CHR$(12)
GH 640 PRINT STRING$(48,"*")
PC 650 PRINT "*  Is the letter properl
       y eligned (Y/N/Esc) ?  *"
GI 660 PRINT STRING$(48,"*"):PRINT:PRI
       NT:LOCATE ,,0
BN 670 B$=INKEY$:IF B$="" THEN 670
GO 680 IF B$=CHR$(27) THEN END
KL 690 IF B$="Y" OR B$="y" THEN RETURN
OF 700 IF B$="N" OR B$="n" THEN PRINT
       "Make adjustments...":RETURN 31
       0
KG 710 BEEP:GOTO 670
HP 720 REM ---ERRORS---
FP 730 IF ERR=53 AND ERL=340 THEN PRIN
       T "Address file not found.":END
PB 740 IF ERR=53 AND ERL=350 THEN PRIN
       T "Letter file not found.":END
ON 750 ON ERROR GOTO 0
MN 760 END                                ©
```


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INSIGHT: Atari

Bill Wilkinson

As I promised, this month will be spent answering more letters. Some of the topics I will discuss here have been requested many times; others are unique queries that provide an insight into the workings of your Atari. I think they are all interesting questions.

Before starting on the questions, though, I have a bit of news that can't wait: Microbits (Albany, Oregon) is currently developing both a *parallel* floppy disk drive and a hard disk system for the 800XL. Preliminary speed measurements indicate that we may be able to read/write over 40,000 bytes per second to and from the disk. Imagine being able to load any of your favorite games from disk in half a second or so. Presumably, you would use the parallel floppy to back up the hard disk. Since even a five-megabyte disk (small by today's standards) takes 25 double-density floppies to back up, anything Microbits does to enhance the speed or density of the floppy will be appreciated.

Microbits has not announced any delivery dates yet (in fact, they haven't even finished development, so they can't deliver anything), but I think you should ask your local dealer to get all the information he can as soon as he can. Just think of the possibilities for graphics applications (do you realize that you could load five or six graphics mode 15 pictures per second this way? Or how about windows?).

Phase Errors

Michael Richardson, of Plattsburgh, New York, used the machine language graphics routines printed in this column in 1982 as the basis for a set of his own routines. He ran up against an unexpected error with the Atari *Assembler Editor* cartridge. Although he did not provide a complete listing, I will present what I believe is a correct excerpt here:

```
10          *= $600 ; (or any other good location)
20 DRIVE = FNAME+1 ; see below
30 ;
40          LDA DRIVE ; looks reasonable, doesn't it?
            ...
            ...
99 FNAME .BYTE "D1 :ANYNAME.*"
```

Now that tiny segment of code certainly *looks* innocuous, doesn't it? But when you try to assemble it, it gives you an ERROR 13, a "phase" error. Why?

Before answering the question, let's consider what would happen if we replaced line 40 with:

```
40          LDA FNAME
```

Do you know what will happen? Can you guess? Believe it or not, you will *not* get a phase error from the *Assembler Editor* cartridge.

Let's take this step by step. Remember that good old ASMED (if you will pardon my inventing an acronym for *ASseMbler EDitor*) is a two-pass assembler. On the first pass, ASMED tries to assemble LDA FNAME and discovers that FNAME has not been defined yet. "That's okay," says ASMED to itself, "I'll just assume that FNAME will be defined later as a non-zero page location. I'll reserve three bytes for this LDA instruction." Well, lo and not-too-surprisingly behold, FNAME is indeed defined later, and it is indeed not a zero page location. Thus, on the second pass through the source code, ASMED generates a three-byte LDA instruction (both in the listing and in the object code). Pass 1 and pass 2 have agreed on how much code to generate. *Voilà*, no phase errors.

What happens, though, when ASMED tries to assemble our original line 40, LDA DRIVE? Well, ASMED is smart (just how smart we will see in a moment), but it's not exactly all-powerful. When it encountered the line DRIVE = FNAME+1, it said to itself, "Aha! FNAME is

undefined. But since it is used in an expression, I must give it a value for now. Hmm. Why not give it a value of zero?"

Why not? Because then FNAME+1 is evaluated by ASMED as 0+1, and DRIVE is given a value of 1. ASMED is *not* smart enough to realize that DRIVE should be considered undefined along with FNAME.

The consequence? During pass 1 of the assembly, ASMED sees LDA DRIVE as being equivalent to LDA $0001, a zero page reference which thus requires only two bytes of memory. But—you saw this coming, didn't you—by the time ASMED gets to LDA DRIVE on pass 2, FNAME has been defined and so DRIVE gets a value of other than one (presumably $06xx in our little example). "Okay," says ASMED, "I'll generate three bytes for the LDA." Oops! Phase error!

Before discussing the fix for this problem, I would like to point out that many (if not all) of the other assemblers available for the Atari would also produce a phase error here. More interestingly, some (many? I haven't had a chance to try them all) would probably produce a phase error even on our other example, where we coded LDA FNAME. If so, it is because they treat undefined labels as having a value of zero, and thus reserve space for only a two-byte instruction on pass 1. The situation gets even stickier with forward referenced and/or undefined macro parameters, as implemented in the various macro assemblers available.

Anyway, what is the fix? Well, my favorite rule is simple: *Never* use a label until *after* you have defined it. I can't think of any occasion where this rule will get you in trouble. I can think of lots of ways that ignoring it can cause strange programming problems. My suggestion for the code in question would be to simply rearrange it, thus:

```
10          *= $600 ; (or any other good location)
20 FNAME .BYTE "D1 :ANYNAME.*"
30 DRIVE = FNAME+1 ; guaranteed to be defined
   now
40 ;
            ...
            ...
99          LDA DRIVE ; always three bytes now!
            ...
```

Give Me Room

Matthew Ratcliff, of St. Louis, Missouri, sent me a very complete listing of a program he calls "GTIA TEXTWRITER" along with some fairly thorny problems. Without repeating the actual questions, I think I can safely say they should all be lumped into the category of assembling relatively large programs on an Atari computer. Since many people (including Ratcliff) are still using ASMED, let's begin with a look at how ASMED uses memory.

Much has been written (here and elsewhere) about how Atari BASIC allocates memory, but I can't remember ever seeing a good description of how ASMED slices up your hard-earned RAM. Shall we rectify that?

First, because ASMED was written primarily by one of the members of the Atari BASIC team (Kathleen O'Brien, and in less than three months), it is not surprising that ASMED shares many of BASIC's allocation techniques. In fact, those of you familiar with BASIC's use of the memory pointers at $80 through $92 would be right at home if you looked at ASMED's source code. There are, however, some major differences.

Just as BASIC has to juggle the several parts of your program (variable name table, the tokenized program, arrays, etc.), so must ASMED find places for its needed components. While you are using just the editor, this task is simple: No tokenizing takes place, no variable name or variable valuable tables are built—just straightforward expands, contracts, and inserts of your source code lines.

When you assemble, though, ASMED must find a place to put your symbol table (all the labels used in your program and what their values are, etc.). For its own convenience, ASMED simply places the symbol table in memory directly following your source code. Object code is easier: ASMED puts your object code where you tell it to. If you are assembling directly to memory, ASMED puts it in memory exactly where your *= directives tell it to.

I spot some potential trouble with that last part, don't you? But let's look at what ASMED can tell us about its usage of memory: Probably the most overlooked tool in the ASMED user's reach is the SIZE command. This is roughly the equivalent of BASIC's PRINT FRE(0). When you use SIZE, you are presented with three hexadecimal numbers. The first is the lowest non-zero page RAM being used by ASMED. The second is the current top-of-the-program source code in memory. (Even if you have no program in memory, ASMED has some fixed overhead, so this number never equals the first one.) The third hex number gives you the top of the memory which ASMED will use. Not surprisingly, the first and third numbers are derived from the Atari OS locations LOMEM (at $02E7) and HIMEM (at $02E5).

Let's take a hypothetical situation (which might really occur if you used a 16K machine with a cassette recorder) where you type SIZE and ASMED responds with:

```
0700 321C 3C1F
```

What does this display tell you? It tells me that this person may be in trouble. He has only $0A03 (2563 decimal) bytes left for his symbol table when he assembles this program. Depending on the size and number of his labels, that may or may not be enough space. But that's only the first problem.

Where is the object code going to go? Aside from poor, overworked page 6 ($0600 to $06FF), there just *isn't* any memory free (and page 6 probably isn't big enough to hold the output from this assembly, anyway). What to do? Well, the obvious answer is to assemble your object code directly to the tape recorder. You do that simply by giving the command:

```
ASM „#C:
```

to ASMED. Then you can use NEW, check memory with SIZE again, and LOAD the object code back in memory, ready to debug it. Not bad. Time-consuming, but it works.

Or does it? Many people complain that after producing an object tape they cannot reload it successfully (usually, they get an ERROR 138, timeout). Why? Simply because ASMED turns on the cassette recorder at the beginning of pass 1, even though it may be a minute or two before pass 2 writes anything to the tape. Also, if you are producing a listing, the time taken to write the tape increases to the point where other start/stop errors are possible. There is no total fix for these problems, but here are some suggestions which might help.

First, do your assembly twice, once for the object code and once for the listing. During the object code assembly, turn off the listing (by using .OPT NOLIST as, say, line 1). Before starting the assembly, zero your tape counter. Then, as the object code is assembled to cassette, listen in (turn up the volume on your television). When you hear the first burst of data being sent to the cassette (near the beginning of pass 2 of the assembly), note the value of the tape counter. Then, to reload the object tape, rewind the tape to about five to ten seconds ahead of the counter value you noted. And that's about as good as you can do using ASMED with a cassette recorder.

Before going on, I'd like to discuss a point I sidestepped a couple of paragraphs ago. I noted that the SIZE command gave the memory used by ASMED (exclusive of symbol table space). Perhaps not obvious to many first-time users of ASMED is that you may *not* direct object code (via *=) to memory anywhere between those first and second numbers. (And you'd better leave a healthy hunk alone above the second number for the symbol table.)

What happens if you don't follow this rule? Typically, you find that your object code tries to share space with your source. Bye-bye, source. Or, worse, you may find the object code sitting on top of the symbol table. This can cause some extremely bizarre symptoms. I have seen ASMED start spitting out hundreds of errors for a single line when this happened.

Despite the fact that ASMED is one of the most bug-free programs I have ever encountered, it has a few very bad design flaws. And as we just noted, one of them is that it will assemble code right on top of memory it is using for other purposes.

However, for the disk user with 40K or more of RAM, ASMED presents no real problems if used properly. Since both the source code *and* the object code may be on the disk, the only real limitations are the sizes of the files. Obviously, the object file can be loaded in after giving a NEW command, so it need only fit between the second and third numbers given when the SIZE command is used.

But what about the source file? At first glance, it might appear that your source file is limited to what can be edited in memory. Not so! Albeit tedious, there is a way to assemble very large source files with ASMED. Simply edit the source code in pieces, none larger than ASMED's buffer space. Then, when all are ready, use the *append* capability of Atari DOS's option C to append one file after another to the first piece of the source. (*Please* do this on a copy of your master disk. It's very easy to make a mistake and append in the wrong direction.) Now you can assemble this giant source file.

There are, of course, some real disadvantages with doing things this way. The biggest of these is obvious: What happens when you get an assembly error in the middle of the fourth of the appended files? You have to edit that file and then go through the backup and append process all over again. Another problem is simply the speed of ASMED. If you expect to assemble 16K of *object* code, even without a listing to the printer, you might as well go out to a movie while you wait. A double feature. Finally, ASMED's extravagant use of zero page memory (leaving you, the programmer, only about 32 bytes) can be a real killer with large programs.

Well, we've wandered a little off the original track here, but it's all been germane to the problems of assembling large programs on your Atari. Is there a general solution to these problems? Several, if you have a disk drive. What are they? Just a nice selection of other assemblers.

ASMED is a usable introduction to machine language programming, but it is (after all) only 8K bytes long, and a lot of features had to be pared to make it fit. So when it begins to grate

on your nerves, get rid of it. What do you get instead?

Since my company (OSS) produces *MAC/65* (also a cartridge-based assembler, editor, and debugger), any answer I give is bound to be prejudiced. So I will simply tell you to go out and compare the prices, features, and speeds of the various assemblers available. You might, for instance, consult *The Book of Atari Software, 1984*, from either the Book Company or Addison-Wesley, which describes several assemblers and gives comparison charts. The advantage of getting a second assembler is that you now know what parts of ASMED you did *not* like, and you can look for assemblers that fix these areas.

16 Megabytes?

The topic heading here does not refer to any secret projects going on behind closed doors. Rather, I have been asked (more times than I can count) about the 16-bit version of the 6502 which has been developed by the Western Design Center (of Mesa, Arizona). I believe it is designated as the 65816, and is purported to be faster than a Motorola 68000 in many operations and capable of addressing 16 megabytes of memory. The question I am asked is fairly obvious: "Can I put this chip in my Atari and address 16 megabytes and make BASIC run faster and . . . ?" The answer is simple: *no*.

I can't let an answer like that sit around naked, so let's see if we can't flesh it out a bit. First, in order to address 16 megabytes, you have to *have* 16 megabytes. Have you seen any 800XLs with a lot of spare RAM floating around lately? Further, addressing 16 megabytes means you *must* have 24 address lines. (The 16 address lines in your Atari computer can access only 64K.) There simply isn't any place provided on the Atari circuit boards for such an expanded address bus.

Now, at least one version of the 65816 is purported to be pin-compatible with existing 6502s. If this is wrong, I apologize. I admit I am repeating what I have been told. Presuming this to be true, though, it may barely be possible to imagine an expansion box for an 800XL which can properly decode some sort of I/O signal to "bank" in additional RAM. I suspect, though, that the pin-compatible version may be so compatible that it limits you to 64K of memory.

So far, however, this highly hypothetical discussion has assumed that the chip will be compatible enough (with a 6502) to fool the rest of an 800XL's circuitry. I'm not convinced that this will prove to be true. Why? Because the 65C02 (which, you may or may not recall, is a CMOS version of the 6502 which adds a few—still all 8-bit—instructions and capabilities) does not work in an 800XL. Even though it works *great* in older Atari 800s.

I am not sure why the 65C02 is incompatible with the 800XL, but I have been told it is because Atari started using a custom version of the 6502 in its newer machines. (The story is that the newer CPU is the same one found in the 2600 game machines, and it has one or two pins used differently.) In any case, the problems with the 65C02 cause me to doubt that the 65816 will enjoy a better fate.

Last, let us assume that you really can plunk a 65816 down into the middle of your 800XL. Will it do you any good? Not unless you are a heavyweight in machine language. Compatible means just that: It executes all standard 8-bit 6502 instructions in the same old way. And where are you going to get any of the new 16-bit instructions from? I dunno. It is extremely doubtful that any major software vendor will be able to justify the expense of developing programs which use the 65816 in an Atari, since using the chip involves doing nasty things to your computer that very, very few users are willing to try.

And there you have it. I hope I am wrong about much of the above, solely for my own personal satisfaction with such a 16-bit machine. But—sigh—I am probably mostly right. (But what if . . . nah . . . it couldn't happen.) ©

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C. Regena

Multiplication Maze

First, a correction. In "Alphabet Song," which appeared in this column in the August issue, change line 1910 GOTO 330 to 1910 ON SP GOTO 330,340 so the program will work properly whether you have the speech synthesizer or not.

Readers have been sending quite a few letters about the "Simple Math" program in the July column. Many of you want to know how to rewrite the program to add higher numbers or modify it for subtraction, multiplication, or division. That particular program used numbers less than five so the sum would be less than ten, and the answer would be one digit. CALL KEY was used to get the answer. To use higher numbers or receive an answer that can be two digits, use two CALL KEY loops. It is better to avoid INPUT wherever possible because INPUT is so easy to crash. This month's program illustrates how to receive an answer that may be either one or two digits long.

Some of the following tips may be useful to you. For subtraction, choose a random number A from one to nine, then a random number B from one to nine. The total of the two numbers is A+B. For the subtraction problem, use A+B for the top number, and B for the number to be subtracted. The answer will be A, which is a one-digit number. For multiplication, choose a random number A from one to nine, then a random number B from one to nine. The answer is A*B and can be a one- or two-digit answer.

For division, choose a random number A from one to nine, then a random number B from one to nine. The product is A*B. To write a division problem, use A*B for the dividend and B for the divisor. The answer will be A. This procedure makes sure you will have whole numbers for the answers, and the answers will be one-digit numbers.

The Faster The Better

This month's program, "Multiplication Maze," is another example of a math drill. First, the program draws a maze. Within the maze are the numbers from one to nine. A random factor or multiplier is chosen and appears in the upper-left corner of the maze. The player uses the arrow keys (on E, S, D, and X) to move, and must go to each number on the maze and type the product of his factor times the number. The faster the player goes around the maze and gets all nine answers, the lower the time score will be. The player should try to get as low a time as possible. (The best score around our house was under 200.) The answer must be correct to continue, so if the student misses answers, it takes up valuable time.

Lines 100–240 clear the screen, then print the title and instructions. Lines 250 and 260 define graphics character 96 to be a solid white square for the design of the maze. If you want to economize, CALL COLOR(9,16,16) will also make a solid square, and you do not need to define character 96. The first method is used in case you want to add other objects in the maze and use other character numbers in color set 9. Lines 270–280 change the colors for the numbers to be printed in the maze so they will be black with a white background.

Line 290 uses DEF to define a function R(X) as a random number from 0 to X−1. This simplifies programming in later statements wherever random numbers are needed. For example, line 590 uses R(3) and R(5) to generate random numbers from 0 to 2 and from 0 to 4, respectively. Line 660 uses R(9)+1, which gives a random

number from 1 to 9.

Lines 300–350 READ values from DATA to limit nine areas for placing the numbers in the maze. The numbers are placed randomly, but this makes sure the numbers are spread throughout the maze. Each area goes from column XA(I) to XB(I) and from row YA(I) to YB(I). As you type the DATA statements, notice that there are three groups of four numbers for each DATA statement. Be sure you get the commas right and don't put an extra comma at the end of a line.

Keeping Track Of Data

Lines 360–440 define characters and symbols for the black-on-yellow color set. The RESTORE statement tells the computer to start reading the next data with line 410. Although this line is not necessary in this program, in general the RESTORE statement can help you keep track of which DATA statements go with which READ statements. In this case, if you happen to make a typing error in lines 330–350, it won't affect the data for the next READ statements, which need data in lines 410–420. These lines define the numbers in order, starting with character 104 as zero and continuing to character 104+9 as nine.

Line 450 initializes the lowest time or low score to be 99999. Later games will use whatever score has previously been the lowest score.

Lines 460–480 wait for the player to press a key to start the game. In the CALL KEY statement, if the status S is 0 or −1, either the same key is being pressed or no keys have been pressed. When a key is pressed, S will be 1.

Lines 490–500 clear the screen, then change the screen color to magenta. You can use whatever color you want (darker colors will look better with the white maze), but I've always liked purple.

Lines 510–560 draw a grid of white lines for the base of the maze. Lines 570–610 randomly erase some of the white squares to create the maze. The loop goes from row 3 to row 21, using only the odd-numbered rows. The CALL HCHAR statements pick a column from 4 to 8 and from 18 to 22 and draw a random number of spaces from 2 to 10. This automatically leaves some vertical paths throughout the maze so it is always possible to reach every point.

Lines 620–640 define the nine possible multipliers, the numbers from 1 to 9, in the array FF(I).

Lines 650–750 randomly place the nine multipliers in the nine areas of the screen, making sure the number has not been used before and that the number is on a white square.

Game Setup

Lines 760–800 initialize the variables which are used to move the player's factor. The player's factor always starts in the upper-left corner of the maze, row 2 and column 4. NR and NC are used to calculate the new row and new column when the factor moves. P is the character number of the previous spot, or the white square.

Lines 810–820 randomly choose the player's factor, which is a number from 2 to 9. GR is then calculated, which will be the graphics character number for the factor with the yellow background.

Line 830 initializes the time T, which is used for scoring. T is incremented within the CALL KEY loops as the computer is waiting for the player to press an acceptable key.

Line 840 repeats the main game loop nine times, so the player needs to go to nine multipliers and give the answers.

Lines 850–890 place the player's factor on the maze and increment the time T. Lines 900–920 detect the player's keypress, which must be an arrow key. CALL KEY(1,K,S) checks the left half of the keyboard. If a key is not pressed, or the key pressed is not an arrow key, the program branches back to line 880 to increment the time. In line 910, the first check is K+1<1 because checking for zero does not always work with some TI-99/4A computers. Line 920 saves several IF-THEN statements by using an ON-GOTO statement. If an arrow key is pressed, K equals 0, 2, 3, or 5 and the program branches to the appropriate direction.

Checking For Valid Moves

Lines 930–1030 define DR and DC depending on the arrow key pressed. DR is the change in row number, and DC is the change in column number. Line 1040 calculates the possible new position on row NR and column NC. Lines 1060–1070 make sure the new position is still within the boundaries of the maze.

Line 1080 checks character G in the new position. In line 1090, if G is 96 or a white square, the move is valid, and the program branches back to line 850 to move the player's factor. But in lines 1100–1120, if G is 32 or a space, the player cannot move and the computer sounds a low beep. Then the program branches back to increment the time and get another keypress.

Line 1130 starts the procedure which results if the player's factor has hit another number. Line 1130 changes the number to an asterisk, and line 1140 sounds a prompting tone. Lines 1150–1190 print the multiplication problem on row 23. Since G is the character number of the number hit on the maze, G−48 is the number, AM. The number to be printed with a yellow background will be 104+AM. The answer will be AM times the player's factor, M.

Lines 1200–1240 blink a question mark and increment the time while waiting for the student to press a number. This time, zero is used in the CALL KEY statement to detect a key pressed anywhere on the keyboard. Line 1240 makes sure the key pressed is a number from 1 to 9 to be accepted. Line 1250 prints the number the player presses.

Line 1260 calculates the correct answer B, and line 1270 defines B$ as the player's answer. Line 1280 checks the length of the correct answer (which can be one or two digits). If the length is 2, then lines 1290–1350 get the player's second digit, which may be a number from 0 to 9. If the answer is only a one-digit number, the program branches to line 1360.

Sound Effects

Line 1360 checks the answer, and if the answer is incorrect, lines 1370–1420 play an "uh-oh" sound, clear the player's answer B$, and branch back for another answer. The answer must be correct to continue the game.

Lines 1430–1460 play a musical arpeggio for the correct answer, then line 1470 clears the problem, and line 1480 continues the game for nine multipliers.

When all nine multipliers have been answered correctly, lines 1490–1510 play a tune of 30 random notes. Lines 1520–1530 clear the screen and print the score. Lines 1540–1560 calculate and print the lowest score.

Lines 1570–1610 print the option to try again and branch according to the player's keypress of Y or N. Line 1620 ends the program.

You can try this program as listed or adapt it to other types of problems. To modify it for addition, simply change all * signs to +. To change to division, you can use a factor M, then put all the possible quotients in the maze. To change to a nonmath subject, define some objects in the maze. Then whenever the player hits an object, print a history question, vocabulary word, or whatever.

If you want to save typing time and effort, I'll make you a copy of this program if you send a self-addressed, stamped envelope, a blank cassette or disk, plus a $3 copying fee to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

Please be sure to specify the title of the program and that you need the TI version.

Multiplication Maze

```
100 CALL CLEAR
110 PRINT "  ************************
    "
120 PRINT "  * MULTIPLICATION MAZE *
    "
130 PRINT "  ************************
    "
140 PRINT ::"A RANDOM FACTOR IS CHO
    SEN."
150 PRINT :"USE THE ARROW KEYS TO M
    OVE"
160 PRINT "AROUND THE MAZE."
170 PRINT :"GO IN ANY ORDER AND TOU
    CH"
180 PRINT "EACH OF THE NUMBERS IN T
    HE"
190 PRINT "MAZE.  AS YOU HIT A NUMB
    ER"
200 PRINT "YOU WILL NEED TO MULTIPL
    Y"
210 PRINT "THAT NUMBER TIMES THE FA
    CTOR"
220 PRINT "AND TYPE THE PRODUCT "
230 PRINT :"MOVE AS QUICKLY AS POSS
    IBLE"
240 PRINT "TO GET THE LOWEST SCORE.
    "
250 CALL CHAR(96,"FFFFFFFFFFFFFFFF"
    )
260 CALL COLOR(9,16,1)
270 CALL COLOR(3,2,16)
280 CALL COLOR(4,2,16)
290 DEF R(X)=INT(X*RND)
300 FOR I=1 TO 9
310 READ XA(I),XB(I),YA(I),YB(I)
320 NEXT I
330 DATA 5,10,2,8,12,20,2,6,22,30,2
    ,8
340 DATA 4,10,10,16,12,20,8,14,22,3
    0,10,16
350 DATA 4,10,18,22,12,20,16,22,22,
    30,18,22
360 RESTORE 410
370 FOR I=0 TO 12
380 READ A$
390 CALL CHAR(104+I,A$)
400 NEXT I
410 DATA 003844444444438,001030101
    038,003844081020 7C,003844180444
    38,000818284870C08,007840780444 3
    8
420 DATA 003840784444438,007C040810 2
    02,003844384444438,003844443C047
    8,0044287C2844,0000007C007C,003
    8440810001
430 CALL COLOR(10,2,12)
440 CALL COLOR(11,2,12)
450 LT=99999
460 PRINT ::"PRESS ANY KEY TO START
    ";
470 CALL KEY(0,K,S)
480 IF S<1 THEN 470
490 CALL CLEAR
500 CALL SCREEN(14)
510 FOR I=2 TO 22 STEP 2
520 CALL HCHAR(I,4,96,27)
530 NEXT I
540 FOR I=4 TO 30 STEP 2
550 CALL VCHAR(3,I,96,19)
560 NEXT I
570 RANDOMIZE
580 FOR I=3 TO 21 STEP 2
590 CALL HCHAR(I,4+R(3)*2,32,R(5)*2
    +2)
```

```
600 CALL HCHAR(I,18+R(3)*2,32,R(5)*
    2+2)
610 NEXT I
620 FOR I=1 TO 9
630 FF(I)=I
640 NEXT I
650 FOR I=1 TO 9
660 F(I)=R(9)+1
670 IF FF(F(I))=0 THEN 660
680 A(I)=F(I)
690 FF(F(I))=0
700 X(I)=R(XB(I)-XA(I))+XA(I)
710 Y(I)=R((YB(I)-YA(I))/2)*2+YA(I)
720 CALL GCHAR(Y(I),X(I),G)
730 IF G=32 THEN 700
740 CALL HCHAR(Y(I),X(I),48+F(I))
750 NEXT I
760 ROW=2
770 COL=4
780 P=96
790 NR=2
800 NC=4
810 M=R(8)+2
820 GR=104+M
830 T=0
840 FOR I=1 TO 9
850 CALL HCHAR(ROW,COL,P)
860 ROW=NR
870 COL=NC
880 T=T+1
890 CALL HCHAR(ROW,COL,GR)
900 CALL KEY(1,K,S)
910 IF (K+1<1)+(K>5)THEN 880
920 ON K+1 GOTO 930,880,960,990,880
    ,1020
930 DR=1
940 DC=0
950 GOTO 1040
960 DR=0
970 DC=-1
980 GOTO 1040
990 DR=0
1000 DC=1
1010 GOTO 1040
1020 DR=-1
1030 DC=0
1040 NR=ROW+DR
1050 NC=COL+DC
1060 IF (NR<2)+(NR>22)THEN 880
1070 IF (NC<4)+(NC>30)THEN 880
1080 CALL GCHAR(NR,NC,G)
1090 IF G=96 THEN 850
1100 IF G<>32 THEN 1130
1110 CALL SOUND(50,165,4)
1120 GOTO 880
1130 CALL HCHAR(NR,NC,114)
1140 CALL SOUND(150,1497,2)
1150 CALL HCHAR(23,14,GR)
1160 CALL HCHAR(23,15,114)
1170 AM=G-48
1180 CALL HCHAR(23,16,104+AM)
1190 CALL HCHAR(23,17,115)
1200 CALL HCHAR(23,18,32)
1210 CALL HCHAR(23,18,116)
1220 T=T+1
1230 CALL KEY(0,KEY,ST)
1240 IF (KEY<49)+(KEY>57)THEN 1200
1250 CALL HCHAR(23,18,KEY-48+104)
1260 B=AM*M
1270 B$=CHR$(KEY)
1280 IF LEN(STR$(B))<2 THEN 1360
1290 CALL HCHAR(23,19,32)
1300 CALL HCHAR(23,19,116)
1310 T=T+1
1320 CALL KEY(0,KEY,ST)
1330 IF (KEY<48)+(KEY>57)THEN 1290
1340 CALL HCHAR(23,19,KEY-48+104)
1350 B$=B$&CHR$(KEY)
1360 IF B$=STR$(B)THEN 1430
1370 CALL SOUND(100,330,3)
1380 CALL SOUND(100,292,3)
1390 B$=""
1400 CALL HCHAR(23,19,32)
1410 CALL HCHAR(23,18,116)
1420 GOTO 1230
1430 CALL SOUND(100,524,3)
1440 CALL SOUND(100,660,3)
1450 CALL SOUND(100,784,3)
1460 CALL SOUND(150,1048,3)
1470 CALL HCHAR(23,14,32,6)
1480 NEXT I
1490 FOR I=1 TO 30
1500 CALL SOUND(40,R(500)+900,2)
1510 NEXT I
1520 CALL CLEAR
1530 PRINT "YOUR SCORE IS";T
1540 IF T>LT THEN 1560
1550 LT=T
1560 PRINT :::"THE LOWEST SCORE IS"
     ;LT
1570 PRINT ::::"TRY AGAIN--Y OR N"
1580 CALL KEY(0,K,S)
1590 IF K=89 THEN 490
1600 IF K<>78 THEN 1580
1610 PRINT :"NO":::
1620 END
```

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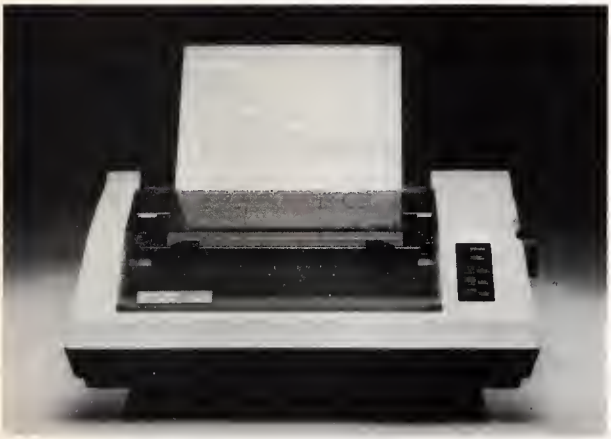
NEWS&PRODUCTS



Axiom Corporation's GP-550 dot-matrix printer offers both draft and near letter-quality printing for $299.

Dual Mode Dot-Matrix Printer

A $299 dot-matrix printer that can print in both near letter-quality and draft modes, the GP-550, has been introduced by Axiom Corporation. It is compatible with most personal computers.

In draft mode, the GP-550 can print up to 86 characters per second with six different character sets: pica, expanded pica, elite, expanded elite, condensed, and expanded condensed. The near letter-quality mode prints up to 43 characters per second and has 12 character sets: pica, expanded pica, elite, expanded elite, italic, expanded italic, superscript, expanded superscript, expanded subscript, subscript, proportional, and expanded proportional.

The printer also has a high-resolution graphics mode with 140 different characters, 18 different print fonts, and self-testing.

The GP-550 can print three copies, including the original, on either fanfold or cut sheet paper. It offers both pinfeed and friction feed as well as bottom feed.

Built-in interfaces for many home computers, such as Apple, Commodore, Atari, and Texas Instruments, are included. An additional model, the GP-550PC, has an interface for the IBM PC and PC compatibles. Units with built-in interfaces start at $319.

Axiom Corporation
1014 Griswold Avenue
San Fernando, CA 91340

Health Monitoring System For Apple, IBM

Avant-Garde Publishing Corporation has introduced *An Apple A Day . . .*, the first entry in its To Your Health series, which includes a data base for medical information and a treatment guide for many ailments.

Designed to run on Apple II and IBM PC computers, the program has files for names, addresses, phone numbers, and directions to all family medical and emergency facilities. It also has space to keep information on health-related tax deductions and insurance policies.

Other files keep track of immunization records, physician visits, x-rays, lab tests, and special conditions such as allergies to medications.

Suggested retail price for Apple II computers with 48K of memory and one or two disk drives is $79.95. The IBM PC version, which requires 64K of memory, retails for $99.95.

Avant-Garde
P.O. Box 30160
1907 Garden Avenue
Eugene, OR 97403

Commodore Magazine Indexes

Altacom, Inc. has introduced *PcDex* and *PcDex Quarterly*, two magazine resource guides for the Commodore 64, VIC-20,

and PET/CBM computers.

PcDex indexes items from 12 Commodore and related general microcomputer magazines—including COMPUTE! and COMPUTE!'s GAZETTE—in six separate categories: subject, title, program listings, software reviews, hardware reviews, and tables of contents. Other features include cross-referencing, program descriptions, updates and revisions, specific machine requirements, and suggestions for locating back issues.

The guide covers magazines published between January 1982 and April 1984. Yearly updates to include the current three years also are planned.

PcDex Quarterly follows the same format, but will be published four times a year with an annual cumulation. It will include any new publications which appear. *PcDex Quarterly* is available by subscription only at $17.95 for one year. *PcDex* is available for $14.95.

Altacom, Inc.
P.O. Box 19070
Alexandria, VA 22314

Strategy Game For 64, Atari

One of the new releases from Microcomputer Games is *Panzer-Jagd*, a solitaire strategy game for the Commodore 64 and Atari home computers that simulates a tank battle between the Russians and the Germans in 1943.

As leader of the German tank division, you maneuver your troops across the terrain of the Soviet Union. The mission is to capture the sector.

The Atari version of *Panzer-Jagd* also includes *Panzerrun*, which adds new terrain and victory conditions to the game. As the leader of a diversionary attack, the mission is to penetrate as far as possible through enemy lines.

Cassette versions for the 64 and Ataris with 32K of memory retail for $25. The disk version for Ataris with 48K of memory and the Commodore 64 retails for $30.

Microcomputer Games
The Avalon Hill Game Company
4517 Harford Road
Baltimore, MD 21214

Integrated Software For Apple IIc

Word processing, budgeting, and list management functions are integrated into one software package in *Jane*, now available for the Apple IIc from Arktronics Corporation.

Jane utilizes a set of pictures to represent system commands and functions. Four onscreen windows allow all three applications to be displayed and used at the same time.

The package includes *Janewrite*, a word processor; *Janecalc*, a spreadsheet calculator; and *Janelist*, a personal filing system.

Jane runs on all Apple II computers with at least 64K of memory. Suggested retail price is $179.

Arktronics Corporation
520 East Liberty Street
Ann Arbor, MI 48104

Cardco has released the CARD/?AT, a parallel printer interface for Atari home computers.

Parallel Printer Interface For Atari

Cardco has announced CARD/?AT, a parallel interface for Atari computers that allows users to connect their computers with any standard parallel printer.

The interface supports all standard Atari printing commands, and works with all standard Atari programs. The Atari 850 Interface Module is not needed. All cables and connectors are included with the interface.

The suggested retail price of the CARD/?AT is $79.95.

Cardco, Inc.
300 South Topeka
Wichita, KS 67202

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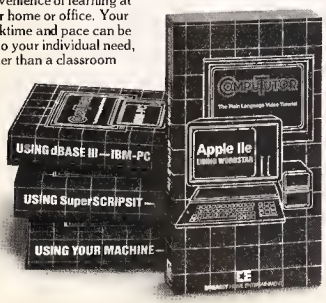

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Memory Expansion, Mouse For PCjr

PCjr Booster, an expansion card which adds 128K of Random Access Memory (RAM) to the IBM PCjr, has been introduced by Microsoft Corporation. The booster also is available with a serial mouse which supports *Colorpaint*, a drawing program for the PCjr.

In addition to the memory expansion, the booster includes a clock/calendar, mouse support, and a copy of Microsoft's *Flight Simulator*.

It enables the PCjr to run languages and large programs such as Microsoft's *Multiplan* and *Lotus 1-2-3* at faster speeds. JBASIC, a software enhancement to the IBM BASIC cartridge, also is included. It allows standard BASIC programs to run on the PCjr as much as 22 percent faster, with twice as much screen memory.

The PCjr Booster with sockets for 128K of memory retails for $295; with the memory included, the retail price is $495. Microsoft's serial mouse is available for $195.

Microsoft Corporation
10700 Northup Way
Bellevue, WA 98004

Home Financial Management Software

Your Personal Net Worth, a home financial management software system for Apple, Atari, Commodore 64, and IBM PCjr computers, has been announced by Scarborough Systems, Inc.

The program comes with two disks, one of which has been preformatted with accounts, but only one disk drive is necessary.

Functions of the program include: setting up a budget with up to 350 categories; keeping a record of all banking and credit card transactions; maintaining a record of the user's net worth; listing tax deductible items; recording stock, bond, and other investment transactions; and documenting household valuables, collectibles, and important papers.

The Apple, Atari, and Commodore 64 formats retail for $79.95. The PCjr version retails for $99.95.

Scarborough Systems, Inc.
25 North Broadway
Tarrytown, NY 10591

Text Adventure For Commodore, Atari, Apple, IBM

Epyx has introduced a new text adventure game based on Isaac Asimov's science fiction detective novel, *Robots of Dawn*. The game is available in versions for the Commodore 64, Atari, Apple, and IBM PC and PCjr computers.

In *Robots of Dawn*, you play the detective "Lije" Bailey as you investigate the murder of Dr. Fastolfe, the father of positronic humaniform robot design. You question an array of suspects from far-flung cultures to determine who committed the murder. Even your robotic friend, R. Daneel, is under suspicion. Visit parts of the city uncovering clues, question suspects, and try to find anyone with a motive.

Circumstances vary each time you play the game, and you can engage in conversations with the game's characters.

The retail price is expected to be in the $29–$35 range for the different computers.

Epyx, Inc.
1043 Kiel Court
Sunnyvale, CA 94089

Atari to CP/M Computer Interface

USS Enterprises has introduced an Atari XL version of its Critical Connection, an Atari to CP/M computer interface which allows an Atari owner to use the disk drives, printer, and keyboard of any computer system running CP/M, as long as the system has a serial port at 19,200 baud.

The original version works with Atari 400 and 800 computers. The new version, Critical Connection XL, interfaces Atari XL computers with CP/M units.

Features include automatic install for many systems, including Kaypro, Heath-Zenith, and NorthStar; hardware that connects the CP/M serial port to the Atari disk/printer port; and software.

Both versions of Critical Connection have a suggested retail price of $175. The company requests that the names of both the Atari and CP/M system be provided when ordering.

USS Enterprises
6708 Landerwood Lane
San Jose, CA 95120

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

COMPUTE! *welcomes notices of upcoming events and requests that the sponsors send a short description, their name and phone number, and an address to which interested readers may write for further information. Please send notices at least three months before the date of the event, to: Calendar, P.O. Box 5406, Greensboro, NC 27403.* ©

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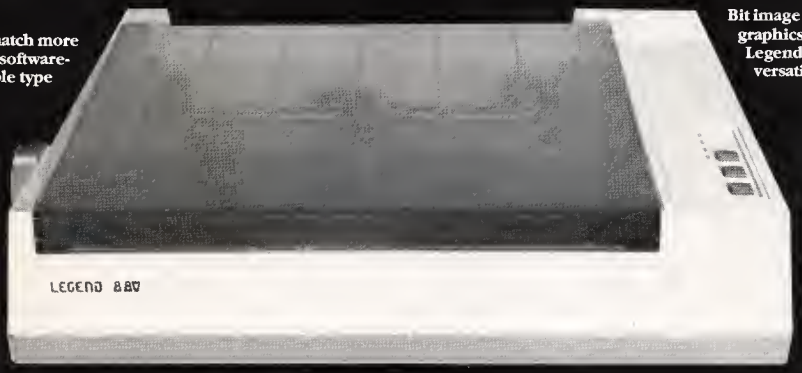

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CA 91367. Telephone (818) 704-9100
Outside CA call toll free 1-800-321-4484
Telex 662436. Dealer inquiries invited

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COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the "Automatic Proofreader." Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [<A>]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S̲.

If a number precedes a symbol, such as {5 RIGHT}, {6 S̲}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See
{CLEAR}	ESC SHIFT <	Clear Screen
{UP}	ESC CTRL -	Cursor Up
{DOWN}	ESC CTRL =	Cursor Down
{LEFT}	ESC CTRL +	Cursor Left
{RIGHT}	ESC CTRL *	Cursor Right
{BACK S}	ESC DELETE	Backspace
{DELETE}	ESC CTRL DELETE	Delete character
{INSERT}	ESC CTRL INSERT	Insert character
{DEL LINE}	ESC SHIFT DELETE	Delete line
{INS LINE}	ESC SHIFT INSERT	Insert line
{TAB}	ESC TAB	TAB key
{CLR TAB}	ESC CTRL TAB	Clear tab
{SET TAB}	ESC SHIFT TAB	Set tab stop
{BELL}	ESC CTRL 2	Ring buzzer
{ESC}	ESC ESC	ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME		{GRN}	CTRL 6	
{HOME}	CLR/HOME		{BLU}	CTRL 7	
{UP}	SHIFT CRSR		{YEL}	CTRL 8	
{DOWN}	CRSR		{F1}	f1	
{LEFT}	SHIFT CRSR		{F2}	f2	
{RIGHT}	CRSR		{F3}	f3	
{RVS}	CTRL 9		{F4}	f4	
{OFF}	CTRL 0		{F5}	f5	
{BLK}	CTRL 1		{F6}	f6	
{WHT}	CTRL 2		{F7}	f7	
{RED}	CTRL 3		{F8}	f8	
{CYN}	CTRL 4		←		
{PUR}	CTRL 5		↑	SHIFT ↑	

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP–RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP–RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```
A$="PROOFREADER.T":B$="{10 SPACES}"
    :FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
    :NEXT:OPEN 1,1,1,A$:CLOSE1
```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

VIC/64 Proofreader

```
100 PRINT"{CLR}PLEASE WAIT...":FORI=886TO10
    18:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT"{DOWN}YOU MADE
    {SPACE}AN ERROR":PRINT"IN DATA STATEMEN
    TS.":END
120 SYS886:PRINT"{CLR}{2 DOWN}PROOFREADER A
    CTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003
```

Atari Proofreader

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POK
    E I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN
     DATA STATEMENTS.  CHECK TYPI
    NG.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER N
    OW ACTIVATED."
```

```
150 END
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96
```

IBM Proofreader

```
10 'Autometic Proofreeder Version 2.00 (
   Lines 270,510,515,517,620,830 chenged
    from V1.0)
100 DIM L$(500),LNUM(500):COLOR 0,7,7:KE
    Y OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CHR
    $(70):ON KEY(15) GOSUB 640:KEY (15)
    ON:GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proofr
    eeder Reedy."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/W
    )-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34:
    POKE 1054,0:POKE 1055,79:POKE 1056,1
    3:POKE 1057,28:LINE INPUT L$:DEF SEG
    :IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$=MID$(L$,2
    ):GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3,
    1)=" " THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$(
    LNUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line numb
    er, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=L
    NUM(P) THEN GOSUB 560:GOTO 150 ELSE
    150
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(CK
    SUM+ASC(MID$(L$,I,1))*I) AND 255:NEXT:
    LOCATE Y,1:PRINT CHR$(65+CKSUM/16)+C
    HR$(65+(CKSUM AND 15))+" "+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P)
    =TEXT$:GOTO 150 'replece line
240 GOSUB 580:GOTO 150 'insert the line
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(MI
    D$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A>9
    6 AND A<123)):NEXT
270 DELIMITER=INSTR(TEXT$," "):COMMAND$=
    TEXT$:ARG$="":IF DELIMITER THEN COMM
    AND$=LEFT$(TEXT$,DELIMITER-1):ARG$=M
    ID$(TEXT$,DELIMITER+1) ELSE DELIMITE
    R=INSTR(TEXT$,CHR$(34)):IF DELIMITER
     THEN COMMAND$=LEFT$(TEXT$,DELIMITER
    -1):ARG$=MID$(TEXT$,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOTO
     340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMIT
    ER=0 THEN LNUM=VAL(ARG$):GOSUB 540:F
    IRST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LAS
    T=VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=LA
    ST:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(X
    )),2)+" "
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(A
    $):CKSUM=(CKSUM+ASC(MID$(A$,I))*I) A
    ND 255:NEXT:A$=CHR$(65+CKSUM/16)+CHR
    $(65+(CKSUM AND 15))+" "
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>"" THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1:
    " FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:GO
    TO 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #1
    :ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
480 GOSUB 800:OPEN ARG$ FOR INPUT AS #1:
    MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:LN
    UM(P)=VAL(L$):L$(P)=MID$(L$,LEN(STR$
    (VAL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase
    progrem - Are you sure";L$:IF LEFT$(
    L$,1)="y" OR LEFT$(L$,1)="Y" THEN MA
    X=0:GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,0
    :ON ERROR GOTO 0:CLS:END
510 IF COMMAND$<>"FILES" THEN 520
515 IF ARG$="" THEN ARG$="A:" ELSE SEL=1
    :GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntex error":GOTD 130
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=P
    +1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LNU
    M(X+1):L$(X)=L$(X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:L
    NUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEXT:
    L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
800 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520
    ELSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG$
    =LEFT$(ARG$,LEN(ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".")=0 THEN
    ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"Stopped.":RE
    TURN 150
650 PRINT "Error #";ERR:RESUME 150
```

MLX Machine Language Entry Program For Commodore 64

Charles Brannon, Program Editor

MLX is a labor-saving utility that allows almost fail-safe entry of machine language programs published in COMPUTE!. You need to know nothing about machine language to use MLX—it was designed for everyone.

MLX is a new way to enter long machine language (ML) programs with a minimum of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter illegal characters when you should be typing numbers. It won't let you enter numbers greater than 255 (forbidden in ML). It won't let you enter the wrong numbers on the wrong line. In addition, MLX creates a ready-to-use tape or disk file.

Using MLX

Type in and save the appropriate version of MLX (you'll want to use it in the future). When you're ready to type in an ML program, run MLX. MLX for the 64 asks you for two numbers: the starting address and the ending address. These numbers are given in the article accompanying the ML program.

When you run MLX, you'll see a prompt corresponding to the starting address. The prompt is the current line you are entering from the listing. It increases by six each time you enter a line. That's because each line has seven numbers—six actual data numbers plus a *checksum number*. The checksum verifies that you typed the previous six numbers correctly. If you enter any of the six numbers wrong, or enter the checksum wrong, the computer rings a buzzer and prompts you to reenter the line. If you enter it correctly, a bell tone sounds and you continue to the next line.

MLX accepts only numbers as input. If you make a typing error, press the INST/DEL key; the entire number is deleted. You can press it as many times as necessary back to the start of the line. If you enter three-digit numbers as listed, the computer automatically prints the comma and goes on to accept the next number. If you enter less than three digits, you can press either the space bar or RETURN key to advance to the next number. The checksum automatically appears in inverse video for emphasis.

To simplify your typing, 64 MLX redefines part of the keyboard as a numeric keypad (lines 581–584):

```
    U  I  O              7  8  9
H   J  K  L  become  0    4  5  6
    M  ,  .              1  2  3
```

64 MLX Commands

When you finish typing an ML listing (assuming you type it all in one session) you can then save the completed program on tape or disk. Follow the screen instructions. If you get any errors while saving, you probably have a bad disk, or the disk is full, or you've made a typo when entering the MLX program itself.

You don't have to enter the whole ML program in one sitting. MLX lets you enter as much as you want, save it, and then reload the file from tape or disk later. MLX recognizes these commands:

SHIFT-S: Save
SHIFT-L: Load
SHIFT-N: New Address
SHIFT-D: Display

When you enter a command, MLX jumps out of the line you've been typing, so we recommend you do it at a new prompt. Use the Save command to save what you've been working on. It will save on tape or disk, as if you've finished, but the tape or disk won't work, of course, until you finish the typing. Remember what address you stop at. The next time you run MLX, answer all the prompts as you did before, then insert the disk or tape. When you get to the entry prompt, press SHIFT-L to reload the partly completed file into memory. Then use the New Address command to resume typing.

To use the New Address command, press SHIFT-N and enter the address where you previously stopped. The prompt will change, and you can then continue typing. Always enter a New Address that matches up with one of the line numbers in the special listing, or else the checksum won't work. The Display command lets you display a section of your typing. After you press SHIFT-D, enter two addresses within the line number range of the listing. You can abort the listing by pressing any key.

64 MLX: Machine Language Entry

```
10 REM LINES CHANGED FROM MLX VERSION 2.0
   0 ARE 750,765,770 AND 860        :rem 50
20 REM LINE CHANGED FROM MLX VERSION 2.01
   IS 300                           :rem 147
100 PRINT"{CLR}{63}";CHR$(142);CHR$(8);:PO
    KE53281,1:POKE53280,1           :rem 67
```

```
101 POKE 788,52:REM DISABLE RUN/STOP
                                        :rem 119
110 PRINT"{RVS}{39 SPACES}";            :rem 176
120 PRINT"{RVS}{14 SPACES}{RIGHT}{OFF}£*£{RVS}{RIGHT} {RIGHT}{2 SPACES}£*£{OFF}£*££{RVS}£{RVS}{14 SPACES}";
                                        :rem 250
130 PRINT"{RVS}{14 SPACES}{RIGHT} £G£{RIGHT} {2 RIGHT} {OFF}£{RVS}££*£{OFF}£*£{RVS}{14 SPACES}";  :rem 35
140 PRINT"{RVS}{41 SPACES}"             :rem 120
200 PRINT"{2 DOWN}{PUR}{BLK} MACHINE LANGUAGE EDITOR VERSION 2.02{5 DOWN}"
                                        :rem 238
210 PRINT"£5{2 UP}STARTING ADDRESS?{8 SPACES}{9 LEFT}";          :rem 143
215 INPUTS:F=1-F:C$=CHR$(31+119*F)
                                        :rem 166
220 IFS<256OR(S>40960ANDS<49152)ORS>53247THENGOSUB3000:GOTO210   :rem 235
225 PRINT:PRINT:PRINT                   :rem 180
230 PRINT"£5{2 UP}ENDING ADDRESS?{8 SPACES}{9 LEFT}";:INPUTE:F=1-F:C$=CHR$(31+119*F)                :rem 20
240 IFE<256OR(E>40960ANDE<49152)ORE>53247THENGOSUB3000:GOTO230   :rem 183
250 IFE<STHENPRINTC$;"{RVS}ENDING < START {2 SPACES}":GOSUB1000:GOTO 230
                                        :rem 176
260 PRINT:PRINT:PRINT                   :rem 179
300 PRINT"{CLR}";CHR$(14):AD=S          :rem 56
310 A=1:PRINTRIGHT$("0000"+MID$(STR$(AD),2),5);":";              :rem 33
315 FORJ=ATO6                           :rem 33
320 GOSUB570:IFN=-1THENJ=J+N:GOTO320    :rem 228
390 IFN=-211THEN 710                    :rem 62
400 IFN=-204THEN 790                    :rem 64
410 IFN=-206THENPRINT:INPUT"{DOWN}ENTER NEW ADDRESS";ZZ           :rem 44
415 IFN=-206THENIFZZ<SORZZ>ETHENPRINT"{RVS}OUT OF RANGE":GOSUB1000:GOTO410
                                        :rem 225
417 IFN=-206THENAD=ZZ:PRINT:GOTO310     :rem 238
420 IF N<>-196 THEN 480                 :rem 133
430 PRINT:INPUT"DISPLAY:FROM";F:PRINT,"TO";:INPUTT               :rem 234
440 IFF<SORF>EORT<SORT>ETHENPRINT"AT LEAST";S;"{LEFT}, NOT MORE THAN";E:GOTO430                        :rem 159
450 FORI=FTOTSTEP6:PRINT:PRINTRIGHT$("0000"+MID$(STR$(I),2),5);":";  :rem 30
451 FORK=0TO5:N=PEEK(I+K):PRINTRIGHT$("00"+MID$(STR$(N),2),3);",";   :rem 66
460 GETA$:IFA$>""THENPRINT:PRINT:GOTO310
                                        :rem 25
470 NEXTK:PRINTCHR$(20);:NEXTI:PRINT:PRINT:GOTO310                   :rem 50
480 IFN<0 THEN PRINT:GOTO310            :rem 168
490 A(J)=N:NEXTJ                        :rem 199
500 CKSUM=AD-INT(AD/256)*256:FORI=1TO6:CKSUM=(CKSUM+A(I))AND255:NEXT  :rem 200
510 PRINTCHR$(18);:GOSUB570:PRINTCHR$(146);                          :rem 94
511 IFN=-1THENA=6:GOTO315               :rem 254
515 PRINTCHR$(20):IFN=CKSUMTHEN530
                                        :rem 122
520 PRINT:PRINT"LINE ENTERED WRONG : RE-ENTER":PRINT:GOSUB1000:GOTO310:rem 176
530 GOSUB2000                           :rem 218
540 FORI=1TO6:POKEAD+I-1,A(I):NEXT:POKE54272,0:POKE54273,0           :rem 227
550 AD=AD+6:IF AD<E THEN 310            :rem 212
560 GOTO 710                            :rem 108
570 N=0:Z=0                             :rem 88
580 PRINT"£";                           :rem 81
581 GETA$:IFA$=""THEN581                :rem 95
582 AV=-(A$="M")-2*(A$=",")-3*(A$=".")-4*(A$="J")-5*(A$="K")-6*(A$="L"):rem 41
583 AV=AV-7*(A$="U")-8*(A$="I")-9*(A$="O"):IFA$="H"THENA$="0"         :rem 134
584 IFAV>0THENA$=CHR$(48+AV)            :rem 134
585 PRINTCHR$(20);:A=ASC(A$):IFA=13ORA=44ORA=32THEN670                :rem 229
590 IFA>128THENN=-A:RETURN              :rem 137
600 IFA<>20 THEN 630                    :rem 10
610 GOSUB690:IFI=1ANDT=44THENN=-1:PRINT"{OFF}{LEFT} {LEFT}";:GOTO690  :rem 62
620 GOTO570                             :rem 109
630 IFA<48ORA>57THEN580                 :rem 105
640 PRINTA$;:N=N*10+A-48                :rem 106
650 IFN>255 THEN A=20:GOSUB1000:GOTO600
                                        :rem 229
660 Z=Z+1:IFZ<3THEN580                  :rem 71
670 IFZ=0THENGOSUB1000:GOTO570          :rem 114
680 PRINT",";:RETURN                    :rem 240
690 S%=PEEK(209)+256*PEEK(210)+PEEK(211)
                                        :rem 149
691 FORI=1TO3:T=PEEK(S%-I)              :rem 67
695 IFT<>44ANDT<>58THENPOKES%-I,32:NEXT
                                        :rem 205
700 PRINTLEFT$("{3 LEFT}",I-1);:RETURN
                                        :rem 7
710 PRINT"{CLR}{RVS}*** SAVE ***{3 DOWN}"
                                        :rem 236
715 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF} ALONE TO CANCEL SAVE){DOWN}":rem 106
720 F$="":INPUT"{DOWN} FILENAME";F$:IFF$=""THENPRINT:PRINT:GOTO310   :rem 71
730 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR {RVS}D{OFF}ISK: (T/D)"      :rem 228
740 GETA$:IFA$<>"T"ANDA$<>"D"THEN740
                                        :rem 36
750 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$:OPEN15,8,15,"S"+F$:CLOSE15   :rem 212
760 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$):POKE782,ZK/256             :rem 3
762 POKE781,ZK-PEEK(782)*256:POKE780,LEN(T$):SYS65469                 :rem 109
763 POKE780,1:POKE781,DV:POKE782,1:SYS65466                           :rem 69
765 K=S:POKE254,K/256:POKE253,K-PEEK(254)*256:POKE780,253             :rem 17
766 K=E+1:POKE782,K/256:POKE781,K-PEEK(782)*256:SYS65496              :rem 235
770 IF(PEEK(783)AND1)OR(191ANDST)THEN780
                                        :rem 111
775 PRINT"{DOWN}DONE.{DOWN}":GOTO310
                                        :rem 113
780 PRINT"{DOWN}ERROR ON SAVE.{2 SPACES}TRY AGAIN.":IFDV=1THEN720      :rem 171
781 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$;E2$:CLOSE15:GOTO720         :rem 103
790 PRINT"{CLR}{RVS}*** LOAD ***{2 DOWN}"
                                        :rem 212
795 PRINT"{2 DOWN}(PRESS {RVS}RETURN{OFF} ALONE TO CANCEL LOAD)"      :rem 82
800 F$="":INPUT"{2 DOWN} FILENAME";F$:IFF$=""THENPRINT:GOTO310       :rem 144
810 PRINT:PRINT"{2 DOWN}{RVS}T{OFF}APE OR {RVS}D{OFF}ISK: (T/D)"      :rem 227
820 GETA$:IFA$<>"T"ANDA$<>"D"THEN820
                                        :rem 34
```

```
830 DV=1-7*(A$="D"):IFDV=8THENF$="0:"+F$
                                    :rem 157
840 T$=F$:ZK=PEEK(53)+256*PEEK(54)-LEN(T$
    ):POKE782,ZK/256                :rem 2
841 POKE781,ZK-PEEK(782)*256:POKE780,LEN(
    T$):SYS65469                    :rem 107
845 POKE780,1:POKE781,DV:POKE782,1:SYS654
    66                              :rem 70
850 POKE780,0:SYS65493              :rem 11
860 IF(PEEK(783)AND1)OR(191ANDST)THEN870
                                    :rem 111
865 PRINT"{DOWN}DONE.":GOTO310      :rem 96
870 PRINT"{DOWN}ERROR ON LOAD.{2 SPACES}T
    RY AGAIN.{DOWN}":IFDV=1THEN800
                                    :rem 172
880 OPEN15,8,15:INPUT#15,E1$,E2$:PRINTE1$
    ;E2$:CLOSE15:GOTO800            :rem 102
1000 REM BUZZER                     :rem 135
1001 POKE54296,15:POKE54277,45:POKE54278,
    165                             :rem 207
1002 POKE54276,33:POKE 54273,6:POKE54272,
    5                               :rem 42
1003 FORT=1TO200:NEXT:POKE54276,32:POKE54
    273,0:POKE54272,0:RETURN        :rem 202
2000 REM BELL SOUND                 :rem 78
2001 POKE54296,15:POKE54277,0:POKE54278,2
    47                              :rem 152
2002 POKE 54276,17:POKE54273,40:POKE54272
    ,0                              :rem 86
2003 FORT=1TO100:NEXT:POKE54276,16:RETURN
                                    :rem 57
3000 PRINTC$;"{RVS}NOT ZERO PAGE OR ROM":
    GOTO1000                        :rem 89
```

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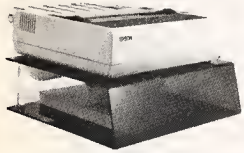

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Modifications Or Corrections To Previous Articles

Atari Canyon Runner

The problem with this game from the October issue (Program 4, page 68) is not just a few missing bytes, as it might appear. A defective version of the program which creates MLX format listings added extraneous numbers to the machine language data. Fortunately, the problem is relatively easy to fix, and if you saved your typing you haven't lost any work.

If you haven't typed in "Canyon Runner" yet, you should enter the data as shown in the October issue. After you enter line 9896, you can either use the MLX Save option (CTRL-S), or add the line 9902 shown below to move to the Save feature. After you have a complete copy of Canyon Runner as published, proceed with the correction process.

First, create a *temporary* modified version of MLX to remove invalid bytes from your Canyon Runner data. Do this by adding *one* of the following sets of lines to MLX:

• If you created a boot tape, add:

```
AJ 935 IF  NOT READ THEN 940
GA 936 BUFFER$(FIN-BEG+103)=CHR$(0
       ):BUFFER$(277)=BUFFER$(281)
       :BUFFER$(529)=BUFFER$(533):
       BUFFER$(781)=BUFFER$(785)
LJ 937 BUFFER$(1033)=BUFFER$(1037)
       :BUFFER$(1285)=BUFFER$(1289
       ):BUFFER$(1537)=BUFFER$(1541)
```

• If you created a binary file on disk, add:

```
AF 825 IF  NOT READ THEN 830
FL 826 BUFFER$(FIN-BEG+127)=CHR$(0
       ):BUFFER$(253)=BUFFER$(257)
       :BUFFER$(505)=BUFFER$(509):
       BUFFER$(757)=BUFFER$(761)
HF 827 BUFFER$(1009)=BUFFER$(1013)
       :BUFFER$(1261)=BUFFER$(1265
       ):BUFFER$(1513)=BUFFER$(1517)
```

• If you created a boot disk, add:

```
NH 1185 BUFFER$(283)=BUFFER$(287):
        BUFFER$(535)=BUFFER$(539):
        BUFFER$(787)=BUFFER$(791)
OG 1186 BUFFER$(1039)=BUFFER$(1043
        ):BUFFER$(1291)=BUFFER$(12
        95):BUFFER$(1543)=BUFFER$(
        1547)
```

These changes are only for fixing Canyon Runner; they are *not* corrections to MLX, and you should not incorporate them as permanent modifications to MLX. The only errors in Atari MLX as published in the October issue were in the article, which failed to mention that on the Atari the special MLX functions are obtained with the CTRL key instead of the SHIFT key. For example, press CTRL-S to save your typing, CTRL-L to reload, CTRL-N to switch to a new address, etc. Also, the instructions for using the LOAD command are only for the Commodore 64.

Next, run the modified MLX (use 8192 for the start and run/init addresses, and 9904 as the ending address). Use the Load option (CTRL-L) to reload your Canyon Runner data. Use the Display option (CTRL-D) to examine lines 9866–9896. The data which was previously at lines 9890 and 9896 should appear to have moved up to 9866–9872. If this is not the case, check your typing of the MLX modifications and repeat this step.

Finally, use the MLX New Address option (CTRL-N) to change the entry address to 9878, then add the following lines:

```
9878:114,105,102,032,116,105,212
9884:104,101,109,097,103,121,023
9890:116,108,117,099,105,102,041
9896:102,105,100,000,000,000,219
9902:000,000,000,000,000,000,174
```

After you enter line 9902, MLX will move to the Save option. For safety, don't overwrite your existing copy of the Canyon Runner data. Use a different tape or disk if you are creating a boot version, or a different filename if you are creating a binary file. The result should be a working copy of Canyon Runner.

VIC Horse Racing

To get the proper checksum for line 670 of this game from the October issue (page 84), add a hyphen between BETS and HORSE. This correction should not affect the operation of the game.

COMPUTE!'s PC & PCjr Magazine Corrections

The following are corrections for the final issue of COMPUTE!'s PC & PCjr magazine (October):

The IBM Automatic Proofreader in that issue (page 49) contains errors in lines 360 and 620 that cause problems with saving and loading programs. The lines should read:

```
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LE
    N(A$):CKSUM=(CKSUM+ASC(MID$(A$,I)
    )*I) AND 255:NEXT:A$=CHR$(65+CKSU
    M/16)+CHR$(65+(CKSUM AND 15))+" "
620 IF INSTR(ARG$,".")=0 THEN ARG$=AR
    G$+".BAS"
```

Early versions of the IBM Automatic Proofreader also require that you insert a space between a SAVE or LOAD command and the filename. The current version does not.

Line 1360 was omitted from "Pyramid Power" (page 40). This line should read 1360 REM. ©

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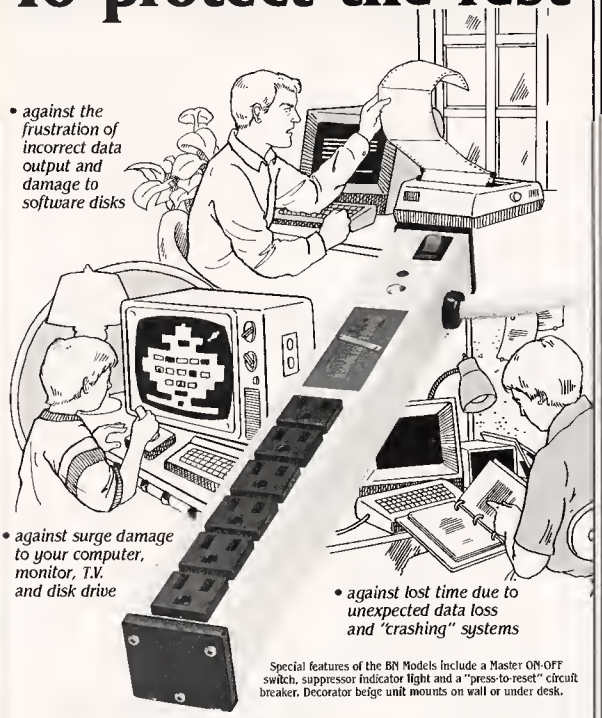

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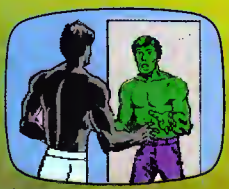

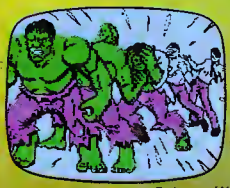

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